
CURATED PAST EXAM ITEMS

- Solutions -

INV 101 – Portfolio Management

Important Information:

- These curated past exam items are intended to allow candidates to focus on past SOA fellowship assessments. These items are organized by topic and learning objective with relevant learning outcomes, source materials, and candidate commentary identified. We have included items that are relevant in the new course structure, and where feasible we have made updates to questions to make them relevant.
- Where an item applies to multiple learning objectives, it has been placed under each applicable learning objective.
- Candidate solutions other than those presented in this material, if appropriate for the context, could receive full marks. For interpretation items, solutions presented in these documents are not necessarily the only valid solutions.
- Learning Outcome Statements and supporting syllabus materials may have changed since each exam was administered. New assessment items are developed from the current Learning Outcome Statements and syllabus materials. The inclusion in these curated past exam questions of material that is no longer current does not bring such material into scope for current assessments.
- Thus, while we have made our best effort and conducted multiple reviews, alignment with the current system or choice of classification may not be perfect. Candidates with questions or ideas for improvement may reach out to education@soa.org. We expect to make updates annually.

INV 101

LEARNING OBJECTIVE 1

ILLUSTRATIVE SOLUTIONS

These Illustrative Solutions are meant to demonstrate the level of knowledge to earn full credit on each Sample Question. They are not meant to depict a perfect solution, and candidates are encouraged to review the relevant Source Materials in conjunction with the solution as provided.

Illustrative solutions have been modified to reflect the current Syllabus. In the case where any part of the solution is no longer contained within the current Syllabus the old solution is struck through (for example, ~~this part of the solution is no longer valid~~). Where the current Syllabus differs from the prior but can be used to answer the question the modified solution is indicated in **blue font**.

Table of Contents

1. QFI PM Fall 2020, Question 2	7
Learning Outcome(s): 1a	7
Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9 th Ed, 2021, Ch 23	7
2. QFI PM Fall 2020, Question 3	11
Learning Outcome(s): 1a	11
Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9 th Edition, 2021, Ch 11; INV101-102-25: High-Yield Bond Primer.....	11
3. QFI PM Fall 2020, Question 8	15
Learning Outcome(s): 1b, 2k.....	15
Source Materials: INV101-100-25: Chapters 3 and 4 of Alternative Investments: A Primer For Investment Professionals, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 19 Portfolio Performance Evaluation	15
4. QFI PM Fall 2020, Question 16	18
Learning Outcome(s): 1a	18
Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9 th Edition, 2021, Ch 60	18
5. QFI PM Spring 2021, Question 4.....	22
Learning Outcome(s): 1b	22
Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18, Ch 19	22
6. QFI PM Spring 2021, Question 5.....	26
Learning Outcome(s): 1a	26
Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9 th Edition, 2021, Ch 10	26
7. QFI PM Fall 2021, Question 4	27
Learning Outcome(s): 1b	27
Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18	27

8. QFI PM Fall 2021, Question 9	30
Learning Outcome(s): 1a	30
Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16.....	30
9. QFI PM Spring 2022, Question 2.....	33
Learning Outcome(s): 1b	33
Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 12.....	33
10. QFI PM Spring 2022, Question 13	37
Learning Outcome(s): 1a	37
Source Materials: INV101-101-25: Overview of Investing in Private Corporate Debt; INV101-102-25: High-Yield Bond Primer; Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021 Ch 10	37
11. QFI PM Spring 2022, Question 17	40
Learning Outcome(s): 1a	40
Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021 Ch 21	40
12. QFI PM Fall 2022, Question 8	43
Learning Outcome(s): 1a	43
Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021 Ch 10.....	43
13. QFI PM Fall 2022, Question 9	48
Learning Outcome(s): 1a	48
Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9thEdition, 2021 Ch 21	48
14. QFI PM Fall 2022, Question 11	52
Learning Outcome(s): 1b	52
Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18	52
15. QFI PM Spring 2023, Question 6	56
Learning Outcome(s): 1a	56

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16.....	56
16. QFI PM Spring 2023, Question 10	58
Learning Outcome(s): 1a	58
Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9 th Edition, 2021 Ch 60	58
17. QFI PM Spring 2023, Question 12	61
Learning Outcome(s): 1b	61
Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 19	61
18. QFI PM Fall 2023, Question 1	64
Learning Outcome(s): 1b	64
Source Materials: Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18	64
19. QFI PM Fall 2023, Question 2	68
Learning Outcome(s): 1b	68
Source Materials: INV101-100-25: Chapters 3 and 4 of Alternative Investments: A Primer For Investment Professionals, CFA Institute.....	68
20. QFI PM Fall 2023, Question 3	70
Learning Outcome(s): 1b, 2k.....	70
Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021: Ch 19: Portfolio Performance Evaluation	70
21. QFI PM Fall 2023, Question 4	73
Learning Outcome(s): 1b	73
Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 14.....	73
22. QFI PM Fall 2023, Question 11	73
Learning Outcome(s): 1a	73

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9 th Edition, 2021 Ch 23	73
23. QFI PM Fall 2023, Question 12	76
Learning Outcome(s): 1a	76
Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9 th Edition, 2021 Ch 22; INV101-102-25: High-Yield Bond Primer	76
24. QFI PM Spring 2024, Question 3	82
Learning Outcome(s): 1b	82
Source Materials: INV101-100-25: Chapters 3 and 4 of Alternative Investments: A Primer For Investment Professionals, CFA Institute.....	82
25. QFI PM Spring 2024, Question 4	84
Learning Outcome(s): 1b	84
Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 19	84
26. QFI PM Spring 2024, Question 5	87
Learning Outcome(s): 1a	87
Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9 th Edition, 2021 Ch 23	87
27. QFI PM Fall 2024, Question 2	90
Learning Outcome(s): 1a	90
Source Materials: INV101-101-25: Overview of Investing in Private Corporate Debt; INV101-102-25: High-Yield Bond Primer	90
28. QFI PM Fall 2024, Question 13	93
Learning Outcome(s): 1b	93
Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 12.....	93
29. QFI PM Fall 2024, Question 14	96
Learning Outcome(s): 1a	96

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9 th Edition, 2021 Ch 23	96
30. QFI PM Fall 2021, Question 14	99
Learning Outcome(s): 1a	99
Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9 th Edition, 2021 Ch 11	99

1. QFI PM Fall 2020, Question 2

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Ed, 2021, Ch 23

This question tests the concept of commercial mortgages and the understanding of cash flow patterns of commercial mortgage-backed securities.

Solution:

- (a) Compare and contrast the default and interest rate risks of these two main types of mortgage loans.

Commentary on Question:

The candidates performed as expected on this section. A few candidates identified permanent and construction loans and correctly listed out the differences in terms of duration, default risk, and interest rate risk. Some candidates received the partial credits, as they were able to describe the loan types and compared the differences without correctly identifying the loan types.

Permanent loans and construction loans are the two main types of commercial mortgages.

- Permanent loans have higher interest rate risk than construction loans.
- Construction loans have higher default risk than permanent loans.
- Construction loans are short-term loans, while permanent loans are long-term loans.

- (b) ~~Recommend which CMBS to purchase based on:~~

(i) ~~Loan-to-Value ratio~~

(ii) ~~Weighted Average Maturity~~

Commentary on Question:

The candidates performed above average on this section. Most candidates correctly calculated LTV ratio and Weighted Average Maturity and then made correct recommendation based on the results. However, many candidates failed to explain that the CMBS-I's WAM better fits the XYZ's liability profile.

(i) ~~Loan-to-Value ratio (LTV):~~

- ~~• LTV for CMBS-I = $(\$200M + \$50M) / \$400M = 0.625$~~
- ~~• LTV for CMBS-II = $(\$220M + \$80M) / \$450M = 0.667$~~

~~From the LTV perspective, CMBS-I is preferred as it has a lower LTV ratio.~~

(ii) ~~Weighted Average Maturity (WAM):~~

- ~~• WAM for CMBS-I = $(4 \text{ years} * 2 * \$50M + 6 \text{ years} * 3 * \$50M) / \$250M = 5.2 \text{ years}$~~
- ~~• WAM for CMBS-II = $(7 \text{ years} * 1 * \$100M + 10 \text{ years} * 2 * \$100M) / \$300M = 9 \text{ years}$~~

~~From the WAM perspective, CMBS-I is preferred given XYZ's substantial liability payments in 6 years.~~

- (c) Calculate the subordination of Tranche A at the beginning of Year 5.

Commentary on Question:

The candidates performed as expected on this section. A few candidates correctly calculated the par value of both mortgage pool and tranche A and then derived the subordination in either percentage or dollar value term. Some candidates received partial credit by describing or showing the formula for subordination.

At the beginning of Year 5:

- Mortgage pool par value = $\$250M - 2 * \$50M = \$150M$

- Tranche A par value = $\$200M - 2 * \$50M = \$100M$
- Subordination = $(\$150M - \$100M) / \$150M = 0.33$ or
Subordination = $\$150M - \$100M = \$50M$

- (d) Recommend which action plan to take based on the expected Holding Period Return in Year 6.

Commentary on Question:

Candidates performed below average on this section. Many candidates only received small partial credits by identifying the holding period return for plan B and recommending the plan with the higher return based on their calculation. Most of them didn't calculate the holding period return of plan A and compared the dollar returns for their recommendation. A few candidates were able to describe how the cash flows through the tranche structure under scenario 1 and recognized that XYZ receives 50% of cash flow received by tranche A. But they failed to calculate the correct interest rate on underlying mortgages, nor the final cash received by the tranche A.

Plan A

Scenario 1:

Interest rate on underlying mortgages =

$$(5\% * \$200M + 8\% * \$50M + 1.4\% * \$250M) / \$250M = 7\%$$

or

$$(5\% * \$100M + 8\% * \$50M + 1\% * \$150M) / \$150M = 7\%$$

Cash flow received by servicer

= Principal + Interest on non-defaulted loan + Recovered amount on defaulted loans

$$= \$50M * 1.07 + \$45M = \$98.5M$$

Cash flow received is first used to pay interest, then to Tranche A and finally to Tranche B.

- Cash flow received by Tranche A = $\$98.5\text{M} - 8\% * \$50\text{M} - 1\% * \$150\text{M} = \93M
- Cash flow received by XYZ = $50\% * \$93\text{M} = \46.5M

Scenario 2:

Coupon payment = $\$50\text{M} * 5\% = \2.5M

Principal payment = $\$50\text{M}$

Total cash flow = $\$2.5\text{M} + \$50\text{M} = \$52.5\text{M}$

Expected cash flow = $\$46.5\text{M} * 60\% + \$52.5\text{M} * 40\% = \$48.9\text{M}$

Calculate XYZ's expected Holding Period Return in Year 6 under Plan A.

$$r_{\text{EOY}} = (\text{CF}_{\text{EOY}} + V_{\text{EOY}} - V_{\text{BOY}}) / V_{\text{BOY}}$$

EOY stands for End of Year, and BOY stands for Beginning of Year.

$$= (\$48.9\text{M} + 0 - \$48\text{M}) / \$48\text{M}$$

$$= 1.88\%$$

Plan B

The expected Holding Period Return is 2.5%.

Recommendation:

Plan B is recommended as it has a higher Holding Period Return in Year 6.

2. QFI PM Fall 2020, Question 3

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021, Ch 11; INV101-102-25: High-Yield Bond Primer

This question tests the candidate's understanding of the characteristics of leveraged loans, CLOs, and high yield bonds.

The candidates performed as expected on this question.

Solution:

- (a) Recommend how the company should seek to sell the loans via assignment or participation.

Commentary on Question:

The candidates performed as expected on this question. Successful candidates described the characteristics of Assignment and Participation, how they affect the borrower and buyer, and provided a recommendation that was supported with solid arguments.

Assignment – Selling a loan through assignment transfers the ownership of the debt to the buyer, and the buyer becomes the lender of record. Borrower needs to approve this transaction.

Participation – Selling a loan through participation does not transfer the ownership, lender of record remains with the original lender. This creates additional credit risk to buyer and cannot achieve best price.

Recommend selling via assignment because both company ABC and the prospective buyers are on good terms with the borrowers. Borrower would

give consent to the transfer of the ownership and ABC can achieve best pricing.

- (b) Explain two ways by which the creation of a CLO would likely add value for ABC.

Commentary on Question:

The candidates performed as expected on this question. Successful candidates explained the benefit of the CLO from company ABC's perspective.

The CLO believes the regulatory required capital for leveraged loans is too high. By selling the loans to the CLO, Company ABC can remove them from balance sheet and reduces the required regulatory capital.

Since ABC already has expertise in leveraged loans, by packaging loans into CLO, ABC can earn additional asset management fees.

- (c) Critique your colleague's statement regarding CLOs.

Commentary on Question:

The candidates performed below average on this question. Unsuccessful candidates failed to recall the CLO being a bankruptcy remote entity. Successful candidates were able to explain the waterfall structure and how the absolute priority rule is violated in the context of loans and bonds.

We disagree with the colleague's statement.

The equity tranche is at the bottom of the CLO's capital structure. The absolute priority rule is often violated in practice, in the context of loans and bonds, which results in junior claims getting some payment before senior claims are paid in full. However, CLO is a bankruptcy remote entity, so it cannot be bankrupt. The absolute priority rule will not be violated for a CLO.

~~The CLO's cash flow waterfall ensures senior creditors will be paid before junior creditors.~~

- (d) The CIO has supplemented the company's investment in leveraged loans with an allocation to high yield bonds. The CIO is concerned about the company's interests in the event the borrower's financial condition deteriorates. Your colleague has suggested researching the following characteristics of high yield bonds:

- Put provisions
- Call protection
- Bullet structure
- Equity warrants

Explain whether each characteristic would address the CIO's concern.

Commentary on Question:

The candidates performed below average on this question. Successful candidates correctly described each characteristic and explained how they will address the CIO's concern when financial conditions deteriorate. Unsuccessful candidates focused on the issuer of the bonds instead, or confused put provision and call protection with a put option and call option.

Put Provision – Put provision allows the bondholder (Company ABC) to accelerate the repayment of debt at a pre-defined price. This could address CIO's concern when financial condition of the borrower deteriorates.

Call Protection – Call protection limits the ability of the borrower to call the paper for redemption for a period of time. This would provide little value if the borrower's position deteriorated, since the borrower would be unlikely to exercise the call.

Bullet Structure – A bullet structure provides call protection for the entire term of the bond. This would provide little value if the borrower's position deteriorated, since the borrower would be unlikely to exercise the call.

Equity Warrants – An equity warrant allows the bondholder to purchase equity at a future date. This would provide little value since the ability to buy equity in the borrower is not valuable if the borrower's position deteriorated.

(e)

- (i) Assess whether each of the asset classes is appropriate in the context of each the above statements.
- (ii) Recommend one of the asset classes.

Commentary on Question:

The candidates performed above average on this question. Successful candidates compared and contrasted all three assets for each statement, and made suggestions backed by solid reasoning.

Statement I

Leveraged Loans

Leveraged loans are issued by counterparties that are below-investment grade, offer more credit exposure than Senior Tranche CLO.

High Yield Bonds

High yield bonds offer more credit exposure than leveraged loans since they are lower on the priority.

Statement II

Leveraged Loans

Leveraged loans consist of term loans between 3 and 7 years with a floating rate component.

High Yield Bonds

High yield bonds will typically mature between 7 and 10 years, with a fixed rate component.

Statement III

Leveraged Loans

Leveraged loans recovery rate is often higher than high yield bonds when facing bankruptcy.

High Yield Bonds

High yield bonds are exposed to high risk of bankruptcy due to low credit ratings issues.

High Yield Bonds are recommended because:

High yield bonds have the most credit risk exposure of the three instruments.

High yield bonds have the longest maturities and are more likely to be fixed rate. These characteristics make high yield bonds a better match to liabilities.

The company can utilize its competitive advantage in bankruptcy negotiation to achieve a violation of the priority rule, demanding a higher than expected recovery rate.

3. QFI PM Fall 2020, Question 8

Learning Outcome(s): 1b, 2k

Source Materials: INV101-100-25: Chapters 3 and 4 of Alternative Investments: A Primer For Investment Professionals, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 19 Portfolio Performance Evaluation

This question tests candidate's understanding on different hedge fund types, the potential concern for survivorship bias, and Sharpe ratio calculation and limitations. Overall, candidates performed below average on this question.

Solution:

(a) Describe:

(i) key features of these two types of hedge fund investments

Commentary on Question:

The candidates performed below average on this part. Some candidates were able to describe the key features of the two hedge fund types. Many candidates were able to explain what survivorship bias is, but only a few candidates were able to identify the potential concern of survivorship bias in these two hedge fund types.

(i) Hedged equity attempts to look for market opportunities by identifying overvalued and undervalued equity securities. Portfolios are not structured to be market neutral and could be highly concentrated in one position. It is the largest of the various types of hedge fund investments.

Fund of funds is a fund that invests in a number of underlying hedge funds. Typically invest in 10-30 hedge funds thus more diversified, but also more expensive because it has to pay two layers of fees.

(b) Critique your colleague's proposal and the reasons given.

Commentary on Question:

Candidates performed below average on this question. Candidates in general answered as expected for Statements 4 and 5. Some candidates only stated agree/disagree, or provided irrelevant explanations, and only partial credit was awarded. Candidates who provided correct explanations to each statement, but did not critique on colleague proposal at the end, also received most of the credit.

1. Disagree - Both investments only open to accredited investors.
2. Disagree - Compensation arrangements are SIMILAR.
3. Agree - Hedge funds often trade in individual securities and concentrates on inefficiencies in micro stock and bond markets, whereas managed futures trade mainly market-based futures and options contracts on

broader baskets of assets and look for return opportunities in macro stock and bond markets.

4. Disagree - Managed futures trade exclusively in derivative markets whereas hedge funds tend to be more active in spot markets while using futures markets for hedging.
5. Disagree - In some jurisdictions, managed futures have been more highly regulated than hedge funds

Managed futures are not more liquid, they are not less expensive, they are traded exclusively in derivative markets, and they are more regulated, so the colleague's proposal is inaccurate.

- (c) Recommend a portfolio from the table above based on her drafted investment objective.

Commentary on Question:

Candidates performed as expected on this part. Many candidates were able to calculate the Sharpe ratio for Portfolio B and C, but some candidates used an incorrect formula. Some candidates did not calculate portfolio A's Sharpe ratio to conclude B and C are better. Some candidates incorrectly interpreted skewness, or did not use this information, to conclude C is better than B.

$$R_f = 3.6\%,$$

$$SR_A = (6 - 3.6) / 12 = 0.2$$

$$SR_B = ((0.9 \times 6 + 0.1 \times 12) - 3.6) / 10 = 0.3$$

$$SR_C = ((0.9 \times 6 + 0.1 \times 9) - 3.6) / 9 = 0.3$$

Both Portfolio B and C have better Sharpe Ratio than the current portfolio.

Alternative investment should be added to the current portfolio. $SR_B = SR_C$

Skewness is a measure of asymmetry in the distribution of returns. All else being equal, a positive value of skewness is desirable.

Portfolio C should be selected as $SR_B = SR_C$, but Portfolio C is positively skewed whereas Portfolio B is negatively skewed. As we aim to achieve consistent positive returns, positive skewness is desirable.

- (d) Describe three ways that the Sharpe ratio can be gamed.

Commentary on Question:

Candidates performed below average on this part. Many candidates stated the limitation of the Sharpe ratio, but did not explain how the Sharpe ratio can be artificially increased. Some candidates only provided the method (ex: buy put) but did not explain how it can increase the Sharpe ratio. Any three statements from below were required to receive full credit.

- Lengthening the measurement interval. This results in a lower estimate of volatility, which in turn improves the Sharpe ratio.
- Compounding the monthly returns but calculating the standard deviation from the monthly returns that are not compounded.
- Writing out-of-the-money puts and calls on a portfolio or adopting strategies that involve taking on some forms of catastrophe risk. This type of strategy can increase the return by collecting option premiums without paying off for years.
- Smoothing of returns: reducing return volatility by having infrequent marking to market of the portfolio assets or having pricing models that understate monthly gains or losses.
- Getting rid of extreme returns: entering into a total-return swap to pay the best and worst returns for the underlying benchmark index and receive fixed cash flow. This way the extreme returns are removed, and volatility is smoothed.

4. QFI PM Fall 2020, Question 16

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021, Ch 60

This question tested the candidates understanding of repurchase agreements.

Solution:

- (a)

- (i) Explain how an overnight repurchase agreement works.
- (ii) Explain why it would be a more cost efficient way to finance this purchase, instead of using the bank's own funds.

Commentary on Question:

Candidates performed above average on this section. Nearly all candidates accurately described how an overnight repurchase agreement works. Some candidates did not explain why they are cost efficient and thus only received partial credit.

- (i) ABC Bank will agree to deliver (“sell”) the security to the customer (“counterparty”). ABC Bank agrees to buy the same security on the next day for an amount determined by the repo rate. The difference between the sale price and repurchase price is the interest cost of obtaining financing.
 - (ii) The advantage is that the repo rate is generally less than the cost of bank financing. From the perspective of the lender, the repo rate is still attractive because the transaction is secured and highly liquid.
- (b) Explain how two common practices are used to reduce credit risk in repurchase agreements.

Commentary on Question:

Candidates performed below average on this section. Many candidates listed common practices but provided no explanation of how they reduce credit risk and thus only received partial credit. Some candidates omitted this part of the question.

- The amount lent should be less than the market value of the security used as collateral. This provides the lender with a cushion should the market value of the security decline. The amount by which the market value of the collateral exceeds the value of the loan is called the margin.
- Another practice to limit credit risk is to mark the collateral to market on a regular basis. The decline in market value below a specific amount will result in a margin deficit. Margin deficits can be cured by either providing additional cash or transferring additional securities.

(c)

- (i) Describe a dollar roll transaction
- (ii) Explain how it differs from repo agreement.

Commentary on Question:

Candidates performed below average on this section. Many candidates accurately stated the dealer in a dollar roll only needs to return “substantially identical securities”, and also that the dealer keeps the coupons and principal paid during the loan period. Many candidates did not describe what “substantially identical securities” means. Most candidates did not mention that the flexibility provided to the dealer may result in a lower financing cost. Some candidates omitted this part of the question.

- (i) A dollar roll is a special type of collateralized loan in the MBS market. In a dollar roll, the dealer only needs to return “substantially identical securities.” These substantially identical securities must match the coupon rate and security type (i.e. issuer and mortgage collateral). This ends up providing flexibility to the dealer. In exchange for this flexibility, the dealer provides 100% financing (i.e. there is no overcollateralization required).
- (ii) Unlike a repo agreement, the dealer who borrows the security does not need to return the exact same securities. The financing cost may be cheaper in a repo due to this flexibility given to the dealer. Additionally, unlike a repo, the dealer keeps the coupon and any principal paid during the period of the loan.

- (d) ABC bank enters into an agreement in which it agrees to sell \$1 million par value of a MBS at $101\frac{7}{32}$ and repurchase substantial identical securities a month later at 101. The coupon rate for this MBS is 7%, paid monthly. The regular scheduled principal payment for the month is \$1,000 and assumed prepayment is projected to be \$3,000

Calculate the financing cost of this transaction in terms of an annual rate.

Commentary on Question:

Candidates performed below average on this section. Many candidates did not accurately calculate the principal repayment premiums gained due to the scheduled payment and prepayment. Many candidates did not have the right sign on some of the components in the total dollar financing cost calculation. Many candidates omitted this part of the question.

$$\text{Lost coupon interest} = 7\% \times 1,000,000 / 12 = \$5,833.33$$

$$\text{Drop} = \$1,000,000 \times 7 / 32 / 100 = \$2,187.50$$

$$\text{Principal repayment premium gained due to scheduled payment} =$$

$$1^{7/32} \times 1,000 / 100 = \$12.19$$

$$\text{Principal repayment premium gained due to prepayment} =$$

$$1^{7/32} \times 3,000 / 100 = \$36.56$$

$$\text{Total financing cost} = \$5,833.33 - \$2,187.50 - \$12.19 - \$36.56 = \$3,597.08$$

$$\text{Financing cost in terms of annual rate} = 3,597.08 / 1,000,000 \times 12 = 4.32\%$$

5. QFI PM Spring 2021, Question 4

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18, Ch 19

This question tests the candidate's understanding of the suitability and structure of private equity investments.

Solution:

- (a) Evaluate the suitability of allocating 5% of its asset portfolio to private equity investments to increase its overall returns and portfolio diversification.

Commentary on Question:

Candidates performed above average on this section.

Most candidates were able to correctly identify the longer time horizon of the pension plan and its ability to tolerate the risk profile of private equities.

Some candidates received no credit for incorrectly arguing the high degree of diversification between public and private equities as a reason to incorporate private equity assets in the asset allocation decision.

Private equity investment bears higher risk than public equity investments. Since we only plan to invest 5% of the asset, the plan should be able to tolerate this higher risk. Private equity returns and public traded share returns have moderately high correlation. Private equity may be a moderate risk diversifier only.

The plan has a relatively longer time horizon as the plan is open to new entrants and has a younger membership profile. This indicates that the plan can tolerate:

- the illiquid nature of private equity investments
- the long-term commitments required by private equity investments
- the higher risk than seasoned public equity investments

Therefore, private equity is suitable for XYZ pension plan.

- (b) Explain the fee structure of a private equity fund

Commentary on Question:

Candidates performed above average on this section.

Most candidates were able to define the fee structure of a typical private equity fund. Those candidates that also provided an explanation of how the fees are applied received full credit.

- Management fee is a flat fee of 2%, on limited partner commitments to the fund.
- Carried interest is fund manager's incentive fee of private equity fund's total profits; the 20%, means that the fund manager's share of the profit.
- Preferred return is the hurdle rate that fund manager has to reach to get the carries interest. The 6% means the fund manager will not get any share unless the profit is above 6%.
- Under the claw-back provision, the fund manager returns specified amount of money if at the end of a fund's life if investors have not received back their capital contributions and share of profit.

- (c) Estimate ABC's average net annual return for the past three years.

Commentary on Question:

Candidates performed as expected on this section.

Most candidates were able to correctly carry out the calculation of management fee, carried interest, and preferred return. Candidates received credit for using arithmetic averaging to derive the annual return.

- Year 1 net return: $12.7\% - 2.0\% - 20\% \cdot (12.7\% - 6.0\%) = 9.36\%$
- Year 2 net return: $4.5\% - 2.0\% = 2.5\%$
- Year 3 net return: $7.8\% - 2.0\% - 20\% \cdot (7.8\% - 6.0\%) = 5.44\%$

The average annual return is therefore:

$$[(1+9.36\%)(1+2.5\%)(1+5.44\%)]^{(1/3)} - 1 = 5.73\%$$

- (d) Evaluate the differences between the direct and indirect private equity investments

Commentary on Question:

Candidates performed as expected on this section.

Most candidates were able to correctly point out the differences in investment vehicles between direct and indirect private equity investments.

Direct private equity is an investment in the preferred convertible stock of a private company, which is senior to common stock in its claims to liquidation value. An event (e.g. buyout or acquisition of its common stocks) will trigger the conversion of preferred stock into common stock.

In contrast, indirect private equity is invested through venture capital or buyout funds. Funds are typically structured as limited partnerships or limited partnership companies with an expected lifetime of 7 to 10 years. The fund manager's objective is to realize the value of the investment portfolio investment by the fund's liquidation date.

- (e) Recommend a private equity investment for the pension plan.

Commentary on Question:

Candidates performed below average on this section.

Many candidates repeated their response from part d) without considering the question in the context of XYZ pension plan.

The purpose of the private equity investment is to increase the investment return and diversification of the portfolio and indirect private equity is recommended.

With indirect private equity, the pension plan can benefit from the fund manager's ability to select worthy investment opportunities, maintain active involvement in the course of the investment, and shore up weaknesses in the company's management.

Direct private equity, on the other hand, would require the pension plan to conduct additional due diligence to identify opportunities, which the pension plan may not have expertise in.

- (f) The CEO chooses to pursue direct private equity investment in order to push for dividend recapitalization to boost the investment returns. Critique the CEO's choice.

Commentary on Question:

Candidates performed below average on this section.

Most candidates did not provide the correct definition of the concept of dividend recapitalization and its effect on leverage.

Some candidates disagreed with the strategy without giving proper justification, and did not receive credit.

Dividend recapitalization involves the issuance of debt to finance a special dividend to owners, sometimes refinancing existing debt in the process.

It is not to use dividend recapitalization to increase the fund returns in the short term while weakening the company by overleveraging it. XYZ pension plan should consider the long-term aspects of the investments to be consistent to the long-term nature of the plan.

6. QFI PM Spring 2021, Question 5

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021, Ch 10

Commentary on Question:

Candidates performed below average on this question. Most set up the calculation of the initial bond price. Some completed it. Few completed the second step below equating the value upon call equal to the current price.

First calculate the initial price of the bond

YTM = 4%

Semi-Annual coupons of $3\%/2 = 1.5\%$

Period (0.5 yr)	Cashflow	Discount factor @ 2.0%	Discounted CF @ 2.0%
1	1.5	.980	1.47
2	1.5	.961	1.44
3	1.5	.942	1.41
4	101.5	.924	93.77
	Price		98.10

Second, calculate the call price, X by setting up the PV of cashflows to equal to the initial bond price. Since the bond is called at the end of year 1 there are only 2 cashflows

Period (0.5 yr)	Cashflow	Discount factor @ 3.0%	Discounted CF @ 3.0%
1	2.0	.971	1.46
2	$2.0 + X$	.943	$(1.5 + X) \cdot .943$
	Equal to initial price		98.10

$$1.46 + (1.5 + X) .943 = 98.10$$

Call price, $X = \$101.03$

7. QFI PM Fall 2021, Question 4

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18

Solution:

- (a) Define the VC investment strategy.

Commentary on Question:

The candidates performed as expected on this section. Candidates received partial credit for stating that VC are investments in newly established companies. Candidates that identified the two categories/stages of VC and the typical sectors in which VC invested received full credit.

Venture capital (VC) relates to equity co-invested with entrepreneurs to fund their young and potentially fast-growing companies. VC is often active in technology sectors such as telecommunications, life sciences, and clean technology. VC has two subcategories, depending on the stage of development of the funded company, early stage and expansion stage.

- (b) Explain why it is more difficult to manage and value VC investments by traditional techniques compared to fixed income assets.

Commentary on Question:

The candidates performed as expected on this section. Candidates that included the cash-burning feature of the investment in their response received full credit. Candidates received partial credit for providing other reasonable responses, such as no market data and unpredictable cash flows.

These investments are still generally in the cash-burning stage and may be several years away from profitability. These characteristics make it difficult to apply traditional portfolio management techniques.

- (c) ~~Compare and contrast moral hazard and adverse selection with examples.~~

Commentary on Question:

The candidates performed as expected on this section. Many candidates received partial credit for explaining moral hazard. Candidates that included examples related to VC or insurance received full credit.

~~Adverse selection takes place before a transaction is completed, when the decisions made by one party cause less desirable parties to be attracted to the transaction. For example, if an LP decides to seek GPs that charge very low fees and offer funds with very favorable terms, the LP is likely to attract unskilled GPs that claim to be skilled.~~

~~Moral hazard, in contrast, takes place after a transaction is completed and can be defined as the changes in behavior of one or more parties as a result of incentives that come into play once a contract is in effect. For example, without proper monitoring, a GP may take excessive risk in order to increase the potential performance fee, or an unskilled manager may decide not to make any investment and just collect the management fee.~~

- (d) Calculate the distribution of sale proceeds between the limited partner and the general partner.

Commentary on Question:

The candidates performed as expected on this section. Candidates that calculated preferred return for LP and catch-up for GP received full credit.

Some candidates received partial credit for simply using 25%/75% to split the 100m gain.

Return of capital to LP +\$200M

Preferred return for LP +\$30M = $\$200 \times 15\%$

100% Catch-up for GP +\$10M = $\$30 \times 25\%/75\% \times 100\%$

Residual amount = $\$300 - \$200 - \$30 - \$10 = \$60\text{M}$

75/25 split of residual amount; LP gets $\$60 \times 3/4 = \45M , GP gets \$15M

In total LP gets = $\$200 + \$30 + \$45 = \275M

GP gets $\$10 + \$15 = \$25\text{M}$

- (e) ~~Recommend the best route for investing in private equity, based on the Company's requirements.~~

Commentary on Question:

~~The candidates performed below average on this section. Many candidates received partial credit for successfully identifying co-investment as the best route or for explaining why other routes are not good. Candidates that explained how co-investment meets the requirement received full credit.~~

~~Avoid cash-burning: If an LP follows the policy of co-investment only in portfolio companies that are already profitable or that would reach profitability soon, this could, for example, mitigate the exposure to cash-burning start-ups.~~

~~Focus on specific industry - Co-investments are a tool for building a targeted allocation to specific investments. Co-investments provide flexibility to~~

~~capitalize on industry-specific and country-specific opportunities as they arise.~~

~~Reduce information asymmetry: As an indirect benefit, a co-investment allows for improved monitoring of the funds and a further reduction of the information asymmetry between fund managers and their investors. It can help LPs better understand the investment process and environment, allowing for better fund selections and reinvestment decisions.~~

~~Recommend co-investment.~~

8. QFI PM Fall 2021, Question 9

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16

This question tests the candidate's knowledge on commercial mortgage-backed securities prepayment and default options.

Solution:

(a)

- (i) Describe possible non-litigious options you could consider.
- (ii) Describe steps of litigious actions you could take.

Commentary on Question:

The candidates performed below average on this part. Many candidates received partial credit for providing one non-litigious option and for answering to sue the borrower in part ii). Those candidates that fully described the steps of litigious actions received full credit.

- (i) One of nonlitigious actions is a transfer of the loan to a new borrower.

A variation on this is to negotiate a ‘short sale’, whereby the lender allows the borrower, threatening default, to sell the property on the borrower’s own. The sale must be approved by the lender.

Another common type of nonlitigious resolution is to a mortgage problem is the procedure known as deed in lieu of foreclosure. In this case, the borrower simply gives the property to the lender in return for the lender releasing the borrower from the debt.

A third approach is for the lender and borrower to work together to restructure the loan, to bring new equity partners into the deal, or otherwise creatively “work out” the problem.

- (ii) As a first step of litigious actions, they can sue for specific performance under the promissory note.

A second level of recourse is for the lender to sue for damages under the promissory note, without invoking the mortgage deed.

The third step is to invoke the mortgage deed to bring a foreclosure action.

The borrower is a “single-asset” wealth-maximizing borrowing entity of sufficient size such that it can pay or prepay this loan. The loan is non-recourse and has one payment remaining of 800,000 due one year from now. The borrower has the right to prepay the mortgage today. One year from today, there are only three possible scenarios for the underlying value of the property.

Scenario 1 - 1,000,000

Scenario 2 - 850,000

Scenario 3 - 700,000

If foreclosure occurs, the costs paid to third parties will be 150,000.

If the borrower decided to pursue a strategic default situation, it is expected the borrower and lender would agree to equally share the

difference between the amount owed and what the lender would receive in the event of a default.

- (b) Describe four ways to mitigate the prepayment and/or credit risks of this loan at issue.

Commentary on Question:

The candidates performed poorly on this part. Many candidates received partial credit for providing one way to mitigate the prepayment risk such as setting high penalties. Candidates that recognized that the borrower is a “single-asset” and recommended ways to avoid a nonrecourse loan situation received full credit.

Unless a prepayment clause is explicitly stated in the mortgage agreement, the borrower does not have the right to pay the loan off early, that is, prior to its original stated maturity. For this loan, we could remove prepayment clauses to reduce the prepayment risk.

We could set prepayment penalties so high as to effectively eliminate the value for the borrower of refinancing the loan at a lower rate or prepaying the loan.

Lockout clause – allows prepayment only after a set period of time.

Defeasance Provisions – Borrower could pay off the mortgage only by providing a series of US Treasury bonds

We could avoid a nonrecourse loan situation by requiring the parent holding company or an individual with large net worth to sign the note with joint and several liability, or may require additional collateral for the loan.

We also want insurance protection against possible borrower bankruptcy and loan modification “cramdown” during a Chapter 11 bankruptcy proceeding, i.e., the “single-asset” borrowing entity really is sufficiently independent of any larger corporation such that the larger corporation’s bankruptcy doesn’t jeopardize the mortgagee’s claim on the property.

- (c) Explain the course of action the borrower should take in each scenario above.

Commentary on Question:

The candidates performed as expected on this part. Many candidates received partial credit for recognizing the correct course of actions the borrower should take. Those candidates that further provided justifications for those actions received full credit.

In scenario 1, the borrower would pay the loan amount because he would receive \$200,000 but only $1,000,000 - 150,000 - 800,000 = \$50,000$ if default.

In scenario 2, the borrower would take strategic default because the property value after foreclosure cost ($850,000 - 150,000 = 700,000$) is lower than loan payment \$800,000 while the property is worth more than the outstanding payment. Thus, the borrower is incited to negotiate a lower payment amount.

In scenario 3, the borrower would take foreclosure because property value \$700,000 is lower than the loan payment \$800,000.

9. QFI PM Spring 2022, Question 2

Learning Outcome(s): 1b

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 12

This question tests candidates' understanding of the four-quadrant model of the real estate market, the distinction between the market value and investment value of a property, and how they relate.

Solution:

- (a) Explain how increased economic activity drives rent in the short term.

Commentary on Question:

The candidates performed as expected on this section. Most candidates received partial credit for correctly noting that there would be an increase in demand for rent. Those candidates that commented that this would shift the demand curve upward and also that rent prices would go up in the short term since the supply of space is largely fixed in the short term received full credit. Some candidates incorrectly concluded that the supply of rental space would increase significantly in the short term, therefore causing rental prices to decrease in the short term.

- In the short term, available commercial and residential space is largely fixed.
- The increased economic activity is an exogenous shock to this dynamic system, which shifts the demand for space upward.
- This increased demand for the relatively fixed space causes rent prices to increase.

- (b) Explain how increased economic activity drives construction activity and rent in the intermediate term.

Commentary on Question:

The candidates performed as expected on this section. Most candidates received partial credit for noting that the value of real estate will increase and that this would lead to additional construction activity, thereby increasing supply of space. The most successful candidates concluded that this increased supply of space would then lead to a decrease in rent prices, but that rent prices would still be higher than their initial level. Some candidates omitted this part of the question.

- In the intermediate term, available commercial and residential space is not fixed, and the supply of space will increase.
- In the asset market, the value of real estate is a function of rent, $P=R/i$. Increased rent drives prices up.
- The construction industry compares the higher real estate values to construction costs.
- All else being equal, higher prices make more construction economically viable and construction activity increases.

- Over time, this results in more rentable space becoming available, and the stock of rentable space increases.
 - The increased available space drives rents partway back down to their initial level.
- (c) Explain investment value (IV) considerations for different investors and developers in a given geographic area.

Commentary on Question:

The candidates performed as expected on this section. Most candidates received partial credit for correctly noting that the IV for a given property can vary between investors depending upon their use of it and also that IV is what the asset is worth if you hold it for a long time. The most successful candidates also explained that the IV is determined by the discounting the user's projected cash flows at their opportunity cost of capital.

- IV is what the asset is worth to you if you don't sell it for a long time.
 - IV may differ for different investors for the same asset at the same point in time.
 - IV uses a cash flow projection specific to the user.
 - IV determined by discounting the projected cash flows, at the opportunity cost of capital. A lower discount rate increases the DCF of the property.
- (d) Propose a negotiating strategy for ABCD to sell the property to the semiconductor company for more than the general market price for each of the scenarios above.

Commentary on Question:

The candidates performed as expected on this section. Some candidates received partial credit for providing appropriate answers for Scenario 1. Some candidates confused the buyer and seller while other unsuccessful candidates simply compared IVs and MVs and did not provide any negotiation strategies. Some candidates omitted this part of the question.

The model solution below represents a plausible (but not exhaustive) list of negotiation points for each Scenario.

- Scenario 1:
 - This is a unique investor and unique asset as part of their plan, so IV and MV may differ greatly.
 - This buyer's campus will give it a unique way to profit from developing this property, giving it a high IV.
 - The pension plan's asset manager's objective is to achieve a sale price close to the IV, extracting the excess value.
 - Research the geographic area and beyond for other potential locations for the buyer's campus.
 - Estimate the buyer's IV, possibly by hiring a real estate appraiser specializing in tech campuses
 - Locate a second-most-motivated buyer, which would increase the MV faced by the tech buyer to this level.
 - Set a reservation price at (or near, to allow for uncertainty) the estimated second-most-motivated buyer's price.
 - Show how the parcel in question is particularly valuable to the desired set of properties for the campus.
 - Emphasize how this geographic area is uniquely suited for the buyer's project.
 - The semiconductor company may have a relatively high IV for the property, so they would enter the market first at a higher price.
- Scenario 2:
 - The pension plan's asset manager's goal is to negotiate the buyer up to the MV
 - Present comparable sale data for similar properties in the geographic area.
 - Identify other potential buyers willing to pay the MV to induce this buyer to pay the MV.
 - Work with the buyer to develop a plan to raise their IV of the property.
- Scenario 3:
 - The usual approach of simply observing the transaction prices of similar assets to estimate the of MV for this property may be used to quickly arrive at a transaction price.
 - Identify ways to reduce transaction costs such as realtor and closing fees.

- Expedite closing of transaction, so buyer can take control of property sooner.

10. QFI PM Spring 2022, Question 13

Learning Outcome(s): 1a

Source Materials: INV101-101-25: Overview of Investing in Private Corporate Debt; INV101-102-25: High-Yield Bond Primer; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 10

This question tests candidates' understanding of corporate bond cash flows, comparisons with other fixed income investments, and risks associated with corporate bond investments. Overall, the candidates performed below average on this question.

Solution:

- (a) Identify four advantages of private debt over high yield bonds.

Commentary on Question:

The candidates performed as expected on this section. The most common problem observed was a lack of familiarity with private debt. Candidates who did well were familiar with the characteristics of private debt and high yield bonds.

Private Debt offers several advantages over high yield:

- Can get a floating rate resulting in lower mark to market volatility
- Typically more secure through covenants.
- Realize an illiquidity premium
- Benefit from further diversification
- Targets higher returns

- (b) Compare and contrast the cash flows for a PIK note with an equity clawback and a bond with a bullet structure.

Commentary on Question:

The candidates performed below average on this section. Many candidates were unfamiliar with the cash flows of a PIK bond. Many did not understand how an equity clawback worked. Candidates who did well focused on when cash flow would be paid by each bond.

- The bullet structure bond is not callable so it pays semi-annual coupons until maturity at which point it pays a final coupon and the par value of the bond.
- The PIK note – allows the issuer for a period of time to make semi-annual coupon payments or pay in kind with more bonds that have the same coupon rate and a par value equal to the coupon. During this PIK period it is possible that no cash is paid by the issuer or cash is paid irregularly or that the cash flow pattern matches the bullet structure bond. After this period ends the issuer can only make coupon payments so the cash flow patterns would be the same.
- The equity clawback gives the issuer the right to refinance some of the bond issue with proceeds from an equity offering. The payment is usually a % of the outstanding bond issue at par value plus one year of coupon. So the cash flow during this time can include payment of a % of par value plus the clawback premium of one year of coupons.

- (c) Explain the event risk the team is concerned about due to this recent increase in merger and buyout activity with regards to the rating of ZZZ Life Insurance.

Commentary on Question:

The candidates performed below average on this section. Many candidates either did not understand event risk or else applied the concept incorrectly. Candidates who did very well were able to explain how the increased merger activity could lead to a potential downgrade for ZZZ life.

- One or more of the companies represented in the collateral could become a merger or buyout target. If that happens, the outstanding bonds of that company could decline in value (spreads could widen) due to the risk that the company will be restructured with higher debt than before the merger or buyout.
- The second risk is that the increased activity alone could cause buyers and traders to withdraw from the industrial bond market causing spreads to widen for all industrial bonds resulting in reduced market value for the current collateral.
- In either case, this increased activity could cause more collateral to be needed to cover the loan. The increase in collateral could result in a rating decrease as forewarned by the rating agency.

(d) Explain two covenants that may appear in the indentures that would make you less concerned about the recent increase in merger and buyout activity.

Commentary on Question:

The candidates performed below average on this section. Most candidates were unfamiliar with the key bond covenants that could protect bondholders against the negative effects of a merger or buyout.

Poison put.

- The bondholder can force the company to buy back the debt.
- This can reduce the likelihood that the company becomes a target.
- If it does become a target it reduces the chance that it will be restructured as a below investment grade credit.

Maintenance of net worth clause.

- If the company is a target and is left with a lower net worth following the buyout or merger this clause may force the company to buy back some of the debt at par.
- This can be valuable if the market price has dropped below par.
- An offer to redeem also may be included instead and the offer is not mandatory. The bondholders may or may not elect to have the bonds redeemed, thus preserving the high coupon debt in low interest rates.

11. QFI PM Spring 2022, Question 17

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 21

This question tests the candidate's understanding of mortgage underwriting and prepayment risk

Solution:

- (a) Since the liability has a duration of 15 years, we can duration-match the liability by purchasing a Mortgage Backed Security (MBS) which uses 15 year fixed-term mortgages as the underlying asset. Since the mortgage rate is locked in at issue for fixed rate mortgages, as long as we can purchase MBS with the right interest rate, we can eliminate the interest rate risk.

Critique his comment.

Commentary on Question:

The candidates performed as expected on this section. Most candidates were able to identify prepayment risk but omitted the duration mismatch or failed to provide comment on interest rate risk.

The Statement is flawed. Unlike conventional Fixed-Maturity Bond, MBS has a unique risk associated with prepayment. The borrower of a mortgage has the ability to prepay their loan before it matures. The duration of MBS with a 15-year fixed-term mortgage is smaller than 15 years. This creates a duration mismatch. Prepayments occur for several reasons: sale of property, destruction of property, default on the part of borrower, curtailments (partial prepayments), and refinancing. While some prepayments are rate-insensitive, refinancing is highly sensitive to current interest rates. In addition, duration matching only protects against parallel yield curve movement. Therefore, fixed-rate MBS still has exposure to interest rate risk.

- (b) Describe the characteristics of Securities A and B to identify which is the Fixed-Maturity Bond and which is the MBS.

Commentary on Question:

The candidates performed above average on this section. Most candidates were able to identify the securities for A and B. Candidates who correctly identified the securities without proper reasons were not rewarded points.

Security B is MBS and Security A is Fixed-Maturity Bond. When the interest rate declines, the prices of bond and MBS rise. However, prepayments in MBS increase as interest rate declines, mortgages and MBS shorten in average life and duration, therefore performance of MBS price lag that of bond without prepayment exposure. Conversely, prepayments slow down when interest rate is rising, causing duration and average life of MBS to increase. This causes MBS price to decrease more than comparable Fixed-Maturity bond. This phenomenon is called “Negative Convexity”. This causes MBS to underperform those of assets that do not have prepayments exposure.

- (c) Explain three sources for the difference between the WAC and a pool’s coupon rate.

Commentary on Question:

The candidates performed poorly on this section. Some candidates did not answer the question. A number of candidates identified the risks or the tranches of MBS, instead of the sources for the difference between the pool’s WAC and the pool’s coupon rate.

- Base servicing – Loan’s note rate that is required to be held by the servicer of the loan. Entity collects payments from mortgagors, makes tax and insurance payments for the borrowers and remits payments to investors. The amount of base servicing fee differs based on the agency and program.

- Guarantee fees (g-fees) – Paid to agencies to insure the loan. Represents the credit risk insurance. There is variation across loan types. Riskier loans require higher g-fees for securitization.
- Excess servicing – Remaining amount of the note that reduces the interest rate to the desired coupon.

(d)

- (i) Explain how this information could be used to determine the credit risk of MBS.
- (ii) Identify which pool has a higher likelihood of default.

Commentary on Question:

The candidates performed brilliantly on this section. Some candidates did not answer the question. For part (i), most candidates were able to explain the factors and the relationship between the factors and the credit risk of MBS. For part (ii), most candidates were able to identify the correct MBS. Candidates who made the correct conclusion without explanations received partial credit.

- (i) Credit score:

- A numerical grade of the credit history of borrower.
- The lower the score, the higher the likelihood of default.

Loan to Value Ratio (LTV):

- Indicator of borrower's leverage at the point when loan application is filed.
- A higher LTV may indicate a greater likelihood of default.

Income Ratio (Debt-to-Income Ratio):

- Compares potential monthly payment to borrower's monthly income.
- A higher DTI indicates a higher likelihood of default.

- (ii) MBS B has a lower credit score, a higher LTV and a higher DTI, so it has a higher likelihood of default.

12. QFI PM Fall 2022, Question 8

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 10

This question tests the concept of fixed price, make whole call provision, tender offers, deferred coupon structures, extendible reset bonds, medium term notes, high yield bonds, credit spread risk.

Solution:

- (a) Contrast a make-whole call provision and a fixed-price call.

Commentary on Question:

The candidates performed above average for this part of the question. Most candidates did well listing the “fixed” vs “interest rate dependent” pieces, but almost no candidate brought up the fact that make whole call provisions are used on investment grade.

- Fixed price call allows a company to call a bond at a fixed price. Make whole call provision call price varies inversely with interest rates
- Fixed calls are usually used on non-investment grade bonds, Make whole call provisions are primarily used on investment grade.
- Fixed price call are generally require more upfront compensation as risk of call is when interest rates fall and issuer will be incented to call to refinance debt when interest rates fall thus harming the investor.
- Make whole call provision requires less compensation up front as call price increases when interest rates fall, thus investor has some level of protection against falling rates.

- (b) Calculate the call price.

Commentary on Question:

The candidates performed as expected for this part of the question. Almost all candidates identified the cashflows correctly. However, very few candidates performed the interpolation on the appropriate discount rates correctly.

- Discount rate is determined by the remaining time to maturity. Thus it is interpolated rate between 1 year and 3 year CMTs.
 $(0.25 \times 1.00) + (0.75 \times 1.20) = 1.15\%$ plus make whole call premium of 10bp = 1.25%
- Cash flow is 6,000 at the end of years 8,9 and 10, and 100,000 at the end of year 10. Therefore, annuity factor for coupon cashflows = 2.945
- Compare discounted cashflows to principal plus accrued interest = 1/2 year coupon.
- Make whole provision call price = $\max[(100,000 + 3,000), 2.945 \times 6,000 + 100,000 \times (1/(1 + 1.25/100)^{2.5})] = \max(103,000, 114,611) = \$114,611$

(c)

- (i) Calculate the tender offer price, at the end of year 8, after the coupon payment has been made.
- (ii) Describe the advantages of using a tender offer.

Commentary on Question:

The candidates performed as expected for this part of the question. Many candidates did get the correct tender offer price, but very few candidates were able to provide more than one benefit of tender offers

- (i) Cashflows after year 8 are only counted as PV calculation is as of the end of the tender offer period. Discount rate is interpolated treasury rate for remaining maturity, need to include fixed spread.

Discount rate = $(0.80 \cdot 0.5 + 0.96 \cdot 0.5) + 12 \text{ bps} = 1.00/100 + 0.0012 = 1.00\%$ [1 pts]
Tender offer price = PV of yr 9 coupon, PV of yr 10 coupon, and PV par amount.
 $6,000 \cdot (1/1.01) + 106,000 / (1/1.01)^2 = \$109,852$

(ii) Advantages of fixed spread tender offers:

- Fixed spread tender offers eliminate the exposure to interest rate risk for both bondholders and the issuer during the tender offer window.
- Firms employ tender offers to eliminate restrictive covenants or to refund debt
- The offer can be for "any or all" of the targeted issue, but it can also be for a fixed dollar amount that is less than the outstanding face value.
- If the firm perceives that the participation is too low, the firm can increase the tender offer price and extend the window.

(d) Describe three different kinds of bonds with deferred coupon structures that XYZ can issue to reduce their debt burden.

Commentary on Question:

The candidates performed brilliantly on this part of the question, with many candidates getting full marks. Some candidates did not provide the names, but provided descriptions, and were given partial credit.

- **Deferred Interest bonds:** The most common kind; they sell at a deep discount and do not pay interest for an initial period, typically from 3-7 years. (sometimes referred to as zero coupon bonds)
- **Step up bonds:** These do pay coupon interest, but the rate is low for an initial period and then increases to a higher coupon rate.
- **Payment in kind bonds** give the issuers an option to pay cash at a coupon payment date or give the bondholder a similar bond. The period during which the issuer can make this choice varies from 5 to 10 years.

(e) Revise the following incorrect statements:

- (i) An extendible reset bond allows the issuer to reset the bond at a fixed spread over the reference rate, with the index spread being specified

in the indenture.

- (ii) In modern practice, if a term bond maybe be paid off by a sinking fund, that means that the issuer accumulates a fund in cash or in assets readily sold for cash, that is used to pay bonds at maturity.
- (iii) High yield bonds are debt instruments coupled with a derivative position, such as options, forwards, swaps, caps and floors.
- (iv) Credit spread is due exclusively to the corporate bond's exposure to credit risk.

Commentary on Question:

The candidates performed above average for this part of the question. Most candidates were able to correct the description of the sinking fund, while fewer candidates were able to correct the statement about credit spread.

- (i) An extendible reset bond allows the issuer to reset the bond at a fixed spread over the reference rate, with the index spread being specified in the indenture.
Correct statement is:

An extendible reset bond allows the issuer to reset the coupon rate so that the bond will trade at a predetermined price.

OR

The structure defined in the statement is a typical floating rate issue.

(Either of the above two is acceptable for full credit)

- (ii) In modern practice, if a term bond maybe be paid off by a sinking fund, that means that the issuer accumulates a fund in cash or in assets readily sold for cash, that is used to pay bonds at maturity.
Correct statement is:

In modern practice, "sinking" means that the money is applied periodically to redemption of bonds before maturity.

OR

The above statement above was the meaning of sinking fund many years ago, not in modern practice. (Either of the above two is acceptable for full credit)

- (iii) High yield bonds are debt instruments coupled with a derivative position, such as options, forwards, swaps, caps and floors.
Correct statement is:

High yield bonds are debt securities issued by corporations with lower than investment grade ratings. Issuing companies are usually looking for money for growth, working capital or other cash flow purposes.

OR

The statement above describes structured notes. (Either of the above two is acceptable for full credit)

- (iv) Credit spread is due primarily to the corporate bond's exposure to credit risk.
Correct statement is: The above statement is misleading because the risk profile of corporate bonds differs from treasuries on other dimensions; namely, corporate bonds are less liquid and often have embedded options.

OR

Credit spread is the difference between a corporate bond's yield and the yield on a comparable maturity benchmark treasury security or swap rate.

(Either of the above two is acceptable for full credit)

13. QFI PM Fall 2022, Question 9

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 21

This question tests the candidates' understanding of the mortgage market and structures of non-agency Residential Backed Mortgage Securities. Overall, the candidates performed below average on this question. While some candidates demonstrated a basic understanding of the mortgage market, many struggled to analyze features of non-agency residential mortgage backed securities.

Solution:

- (a) Explain four factors that are considered in the evaluation of the creditworthiness of a potential borrower.

Commentary on Question:

The candidates performed as expected on this section. Some candidates only identified factors and did not explain them, which earned only partial points.

Credit scores – a numerical grade of the credit history of the borrower. Helps to predict credit and prepayment performance. Higher score is better.

Loan-to-Value (LTV) Ratio – indicator of borrower's leverage. Compares the value of the desired loan to the market value of the property. Lower LTV is better.

Combined LTV (CLTV) – accounts for the existence of any second liens and are more indicative of the borrower's credit standing & indebtedness than LTVs. Lower CLTV is better.

Income ratios – calculate debt-to-income (DTI) ratios that compare potential monthly payment on the loan to the borrower's monthly income. Lower DTI is better.

Front-end ratio – divide total monthly payments on the home by the borrower's pretax monthly income. Lower Front-end ratio is better.

Back-end ratio – similar to front-end but includes other debt payments and obligations to the total payments. Lower Back-end ratio is better.

Documentation – require potential borrowers to provide data on financial status with documentation. Typically, borrowers are required to report and document income, employment status, and financial resources.

(b) ~~Describe four capital structure features that can be utilized to manage the risks of this non-agency RMBS.~~

Commentary on Question:

~~The candidates performed poorly on this section. Most candidates identified or described a sequential structure and were unable to describe other capital structures or provisions to help manage risks. Virtually no candidates referenced the risks of Option Adjustable-Rate Mortgages.~~

~~Issue with floating coupon, since backed by ARM collateral, which is floating rate.~~

~~Should have a linear structure, since it has only one collateral group, and cash flows from this collateral group distributed to all bonds.~~

~~Sequential structure – senior class tranches paid principal sequentially with all principal going to one tranche until it's paid in full before the next senior tranche starts to receive payments.~~

~~Pro rata structure – make payments proportional to each tranche's unpaid principal balance.~~

~~Lockout period – subordinate bonds locked out of receiving prepayments for a period of time after settlement. At the end of the lockout period, if collateral performance meets or exceeds minimum credit conditions, prepayments can flow into junior classes.~~

~~Triggers—series of trigger tests to place limits on the amount and timing of any release of credit support to ensure credit support is still intact during the period when deals are most likely to experience losses~~

~~Common trigger tests include delinquency test, factor test, credit support level test, and cumulative loss trigger test.~~

~~Clean-up call provision—gives owner of the call the option to purchase the remaining bonds at a pre-specified price when the factor is at or below a certain threshold.~~

(c)——

(i)——~~Recommend an internal credit enhancement structure.~~

(ii)——~~Explain the mechanics of your recommended structure.~~

Commentary on Question:

The candidates performed poorly on this section. Some candidates identified the overcollateralization/excess spread (OC/XS) structure did not describe the mechanics of the structure or justify the recommendation. Virtually no candidates referenced the risky nature of Option Adjustable-Rate Mortgage to justify their recommendation.

~~Recommend overcollateralization/excess spread (OC/XS) structure.~~

~~Structure typically used for collateral with greater loss concerns~~

~~Since Option ARMs have a large percentage of loans with little to no documentation, they have a higher likelihood of credit loss.~~

~~Under OC/XS structure, additional layers of support are added to the senior/sub structure through extra collateral principal and/or interest.~~

~~Uses the senior, mezzanine, and subordinate framework but adds extra collateral so that the collateral backing the deal is larger than the total balance of its bonds.~~

~~Since the collateral WAC (weighted average coupon) is expected to be higher than the WAC of the underlying bonds, there can be extra interest payments (excess spread) each month.~~

~~XS spread is the first line of defense, then OC, then the traditional subordinate tranches provide final protection before losses reach senior tranches.~~

~~If OC not fully funded at inception, XS (after covering losses) will be used to build up OC.~~

~~OC/XS deals typically pay floating rate.~~

~~There is typically a step-down date, which is when junior bonds can start to receive principal and the OC can start to be released.~~

~~Cashflows are much more volatile, due to having more trigger events. Small changes in performance can trigger large swings in the cash flow waterfall and have a major impact on a bond's valuation.~~

- (d) Describe four reasons which would explain why prepayments slowed down.

Commentary on Question:

The candidates performed below average on this section. Many candidates provided at least one explanation for why prepayments slowed.

Lower sales of property

Less fires and natural disasters

Less defaults on the part of the borrower

Less refinancings

Borrower mortgage interest rate below market rates ("low note rates")

14. QFI PM Fall 2022, Question 11

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18

This question tests the candidates' understanding of venture capital investments and their role in an institutional portfolio.

Solution:

- (a) Describe two concerns about young venture capital funds that focus on rapid IPOs with respect to the returns of private equity.

Commentary on Question:

The candidates performed below average on this section. The candidates were successful at identifying the negative impact on the return of a rapid IPO and its consequence for the investor. Almost none of the candidates considered the market condition as a contributor to the value of the company at the time of an IPO.

The focus on rapid IPO of a new venture capital might be due to the large inflows of capital in the market. With so much capital to invest in the market chasing for a good deal, this may result in overvaluation of the company which result in an IPO not based on real economic value of the company.

Usually, a start-up company needs time to grow after huge losses in the first few years. A rapid IPO may not encourage a good development of the real potential of the company. This may result in undervaluation and causes real wealth losses in the form of underpriced IPO and lower equity value.

- (b) Describe the J-curve effect.

Commentary on Question:

The candidates performed below average on this section. Very few candidates described the potential to realize a successful IPO and its impact for the investors. The majority explained only the shape of the curve relative to the rate of return. A few candidates explained the negative return associated with the loss in the first years.

This curve represents the life cycle value of the venture capital fund. During the first 4-5 years, the venture capital fund produces a pile of losses which generate a negative return. Such loss eventually will be financed by the profit of successful start-up companies in the fund, whose positive cash flows will overcome the initial losses and result a net profit for the fund. The last stage is the windup or liquidation of those companies and realization of the residual value of the fund. The risk of a complete loss of investment is higher as the risk of failure for new and young companies is high. In any industry there are always failures since not every start-up company makes it to the IPO stage.

- (c) Justify the contribution of the general partner to the investment process.

Commentary on Question:

The candidates performed below average on this section. A few candidates were successful at identifying the general partner (GP) as an expert to identify the opportunities and a key person for the success of the start-up. The majority of the candidates did not describe the role of the GP in attracting investors and identifying the timing for an IPO.

The GP can contribute by:

- Recognizing business opportunities.
- Bringing expertise to the start-up company to make a profit.
- Assessing timing and likelihood of an exit strategy.

- Maintaining contact with companies able to acquire the start-up companies and investment bankers to facilitate an IPO or other venture capitalist for the second round of financing.

(d)

- (i) Describe two characteristics of venture capital investments for each perspective.
- (ii) Evaluate whether the venture capital investments are appropriate for the pension plan for each perspective.

Commentary on Question:

The candidates performed below average on part (i) of this section. Most candidates did not provide relevant descriptions of the specific characteristic of venture investments.

The candidates performed above average on part (ii) of this section. Almost all candidates were successful at justifying the venture capital investment due to the time horizon and recognized the VC as diversifier of the traditional assets. The candidates failed to consider the impact of negative returns in the first years and the need to maintain liquidity to meet the call commitment.

(i)

- a. Investment return
 - Over a long-term horizon the returns of VC investments are expected to outperform the S&P 500.
 - The venture capital needs to be compensated for risks of failure of start-up company.
- b. Time horizon
 - The venture capital fund is generally a long-term investment with a time horizon of 10 years or more.

- Initial losses during the first 4 or 5 years will only be made up over a long time which requires the investors to be patient and long-term oriented.
- c. Liquidity
 - There is no public market for trading investments in venture capital so it is highly illiquid.
 - Investors must commit capital investment in the fund-raising stage and expect to invest the capital later (4-5 years after the fund-raising).
- d. Diversification
 - The regional concentration of a venture capital does not provide sufficient diversification.
 - Venture capital does not invest in any single investment but diversifies across several investments.

(ii)

- a. Investment return

Acceptable if pension plan could accept negative returns on this investment especially at time of capital calls by venture capitalists when the venture capital fund is in deficit.
- b. Time horizon

The pension plan currently supports a young workforce and has limited short term payout expectations. Given the long-term nature of the liabilities, long-term investments in venture capital is an appropriate way to increase the long-term expected return.
- c. Liquidity

Liquidity requirements are acceptable since the pension plan has low immediate liquidity needs in terms of short term payout to retirees. However, the plan must manage the liquidity needs at the time of commitment calls by the general partner.
- d. Diversification

Studies have shown that VC has a low correlation with traditional assets classes, and therefore VC investments could provide good diversification for a portfolio of bonds and stock of the current pension fund.

- (e) Recommend a vehicle for the pension plan.

Commentary on Question:

The candidates performed below average on this section. Most candidates correctly recommended limited partnership as the proper investment vehicle. Only a minority of candidates explained more than two key elements for the justification.

Limited partnership is recommended for the pension plan because:

- Since VC investments is a small part of pension assets, it is not easy to justify recruiting or retaining experts or developing extensive expertise within the pension plan;
- The LLP vehicle requires less influence and interventions from the pension plan on the fund's operations than LLC;
- The LLP is an appropriate form to meet the objective to be a passive investor without knowledge and possibility with of a large group of small investors.

15. QFI PM Spring 2023, Question 6

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16

This question tested candidates' understanding of mortgages and commercial mortgage-backed securities.

Solution:

- (a) Describe three differences between residential and commercial mortgages.

Commentary on Question:

Candidates performed above average on this question. Many candidates received full credit for identifying and briefly describing three differences

between residential and commercial mortgages. Candidates that provided one or two differences received partial credit.

Residential and commercial mortgages have several differences, which include:

1. Residential mortgages are typically smaller loans on average and more numerous than commercial mortgages.
2. Residential loans are typically owner occupied and generate no income by themselves. Commercial mortgages loans are serviced by the income generated from their use.
3. Residential mortgages borrowers are not typically financial or business professionals and have a wide spectrum of financial knowledge. Commercial mortgages borrowers are usually much more sophisticated and have more expertise with financial products.

- (b) Identify four typical mortgage covenants.

Commentary on Question:

Candidates performed below average on this question. A few candidates received full credit for their responses. Some candidates received partial credit for listing fewer than four covenants.

Four typical mortgage covenants include:

1. Promise to Pay Covenant
2. Due-on-Sale
3. Good Repair Clause
4. Acceleration Clause

- (c) Describe the borrower's put option in a non-recourse mortgage.

Commentary on Question:

Candidates performed as expected on this question. Some candidates received full credit for their responses. A common mistake was not describing the put option correctly.

In a nonrecourse mortgage, the borrower's put option is the ability of a borrower to default on a loan and effectively sell the underlying property at a price equal to the outstanding loan balance. The lender rids themselves of a liability equal, at least in book value, to the outstanding loan balance, and the lender loses an asset with this same book value.

16. QFI PM Spring 2023, Question 10

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 60

This question tests the candidates' understanding of repurchase agreements, securities lending agreements, and TIPS.

Solution:

- (a) Describe how you would construct a repurchase agreement. You contract with manager Z to borrow the funds needed.

Commentary on Question:

The candidates performed below average on this section. Many candidates correctly identified the borrower and lender. Many candidates correctly noted the need to buy back the collateral at a specified repurchase price. Very few candidates discussed the investment of the borrowed funds or the fact that manager Y pays you the interest income from the security issuer. No candidates mentioned that the amount earned from the repo is uncertain or can be negative.

- You are the borrower of funds using the 20-year Treasury Notes as collateral.
- Manager Y is the lender of funds you need.
- You invest the cash received from manager Y and at the repurchase date pays interest to manager Y based on the repo rate.

- Manager Y pays you any interest income that you would have received from the issuer of the security.
- The amount earned by you from the repurchase agreement is uncertain and, in fact, can be negative.
- At the repurchase date (3 days later), you buy back the US Treasury Note from manager Y at the repurchase price (which includes interest).

(b) Describe how you would construct a securities lending agreement.

Commentary on Question:

The candidates performed below average on this section. Many candidates correctly identified the borrower and lender. Many candidates correctly noted the need to buy back the collateral at a specified repurchase price. Some candidates correctly described the rebates and interest income from the security issuer. No candidates mentioned that the amount earned from the repo is uncertain or can be negative.

- You are the security lender (beneficial owner of 20-year Treasury Note securities).
- Manager Z is the security borrower.
- You invest the cash received from manager Z, and at the end of the transaction, you rebate part of the income earned to manager Z.
- The amount earned by you from security lending is uncertain and, in fact, can be negative.
- Manager Z pays you any interest income that you would have received from the issuer of the security.
- At some future time, you request the return of 20-year Treasury Note securities and return the cash collateral to manager Z.

(c) Calculate the risk premium embedded in the bonds.

Commentary on Question:

The candidates performed as expected on this section. Nearly all candidates earned either full credit or no credit on this section. A few papers received partial credit either due to calculation error or simply listing an appropriate formula without performing any calculation. Full credit was awarded to

candidates who used one of the two methods shown below and arrived at the corresponding final answer.

- Risk adjusted break-even inflation rate = Break-even inflation rate – Inflation risk premium
 - Break-even inflation rate = $(1 + \text{conventional nominal yield}) / (1 + \text{TIPS real yield}) - 1$
 - Risk adjusted break-even inflation rate = $(1 + \text{Conventional nominal yield}) / (1 + \text{TIPS real yield}) - 1 - \text{Risk premium}$
 - $3.1\% = (1 + 7\%) / (1 + 3\%) - 1 - \text{Risk premium}$
 - Risk premium = $1.0388 - 1 - .031 = .0078$ (78bps)
 - Or, alternatively, Risk premium = Conventional nominal yield – TIPS real yield – Risk adjusted break-even inflation rate = $7\% - 3\% - 3.1\% = 0.9\%$.
- (d) Explain why the portfolio manager would consider the TIPS bonds over the US Treasury notes.

Commentary on Question:

The candidates performed below average on this section. Nearly all candidates correctly noted that TIPs are a defensive hedge against inflation. Partial credit was awarded for each appropriate justification provided. The full list of explanations provided below was not necessary to receive full credit for this section.

- TIPS are a defensive hedge against inflation.
- Investors speculate on changes in inflation and interest rates.
- TIPS have fixed real yield, low correlation to traditional financial assets and muted volatility. They can help achieve long term goals.
- High correlation with Treasuries
- Modest correlation with other asset classes
- Portfolio manager seeking higher returns without increased risk
- Defensive allocation to preserve past gains
- Strategic decision in an ALM context
- Investor may have return objective identified in real terms

17. QFI PM Spring 2023, Question 12

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 19

This question tests the concept of Leveraged Buyout and its difference from Venture Capital.

Solution:

- (a) Define leveraged buyouts (LBOs).

Commentary on Question:

Candidates did above average on this section. Most were able to describe buying a company's stock. Some came up short by not explicitly mentioning taking the company private.

Leveraged buyouts are a way to take a company with publicly traded stock private, or a way to put a company in the hands of the current management.

- (b) Calculate the annual compounded return for this investment.

Commentary on Question:

Candidates performed below average on this section. Some were able to calculate the first or second part of the solution and received partial credit. Common mistakes were incorrect rates in the first part or the wrong equity financing value in the second part.

Value of long-term cash flow = EBITDA after LBO / (Discount Rate - Long-Term Growth Rate)

$$\$200\text{million}/(0.12 - 0.04) = \$2.5\text{billion}$$

Total Return = (Value of Long-Term Cash Flow / Equity Financing) ^{1/years} - 1

[\$2.5billion/\$100million]^{1/9} - 1 = 43.0%

- (c) Identify four methods that the management of the company can use to realize the value of the LBO deal.

Commentary on Question:

Candidates performed below average on this section. Many candidates were able to list some ways to realize value but were not able to identify all four methods. Many mentioned management improving efficiency or unlocking the entrepreneurial mindset, but the focus of the question is how the value of the deal can be directly realized.

- The management can sell the company to a competitor or another company that wishes to expand into the industry.
- An initial public offering.
- Another LBO.
- Straight refinancing

- (d) Recommend an LBO candidate to the firm.

Commentary on Question:

Candidates performed above average on this section. Most were able to identify the correct company, but three reasons were needed to attain full credit. Candidates did not need to calculate any metrics to receive full credit.

Recommend Company B.

1. A history of profitability with steady profit margins.

- The operation and net margins for Company B is 13% and 7%
- The operation and net margins for Company C is 9% and 4%

2. Strong free cash flows to service additional debt levels
 - Company B generates a significant free cash flow after interest and taxes. This shows the ability to support and service a higher debt ratio.
 3. Balance sheet is not already overburdened with a high debt level
 - Company B debt equity ratio is 51%. This would allow Company B to take on additional debt in a leveraged buyout
 - While Company C debt equity ratio is 76%. The balance sheet is already overburdened with a high debt level.
 4. A strong balance sheet with a large cash/current asset balance.
 - Company B, 61% of its assets identified as current assets
 - Company C, only 45% of its assets identified as current assets
 5. A weak stock price.
 - Price per share of Company B has languished
- (e) Identify four benefits of LBOs to both corporate management and investors.

Commentary on Question:

Candidates performed below average on this question. Many candidates were able to identify some benefits but were not able to list four relevant ones. Several mentioned management improving efficiency or unlocking the entrepreneurial mindset. However, the focus of the question is the direct benefit to management, such as equity share and freedom, which will then incentivize management to make efficiency improvements.

From the perspective of corporate management, the benefits of a buyout are:

- The use of leverage whose interest payments are tax deductible.
- Less scrutiny from public equity investors.
- Freedom from a distracted corporate parent.
- The ability of the management of the company to become significant equity holders and to enjoy the upside of building the business.

From the investor side:

- The bid price for their shares is typically at a large premium compared to the market price.

- (f) Compare two private equity strategies: venture capital and leveraged buyouts.

Commentary on Question:

Candidates performed as expected on this section. Most candidates received partial credit for differences in investment strategy and differences in return/risk. However, most did not discuss that the nature of control is different between VC and LBO.

- Equity stake. A venture capital firm will typically acquire a significant, but minority position in the company.
- Control is not absolute. Conversely, in a leveraged buyout, all of the equity is acquired, and control is absolute.
- Target internal rate of returns. Venture capital target IRRs are higher. There is more risk funding a nascent company with brand new technology than an established company with regular and predictable cash flows.
- Investment strategy. Venture capital finance new but unproven technology. Conversely, leveraged buyouts look to see where they can add operating efficiencies or expand product distribution.

18. QFI PM Fall 2023, Question 1

Learning Outcome(s): 1b

Source Materials: Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18

This question tested the candidates' understanding of venture capital.

Solution:

- (c) Explain why venture capitalists are not passive investors.

Commentary on Question:

The candidates performed below average on this section. While most candidates correctly noted that venture capitalists take an active role in the company, many of them did not provide any additional explanation.

Venture capitalists are not passive investors because:

- Once they invest in a company, they take an active role either in an advisory capacity or as a Director on the Board
- They monitor the progress of the company, implement incentive plans for the entrepreneurs and management, and establish financial goals for the company
- They provide management insight
- They usually have the right to hire and fire key managers, including the original entrepreneur
- They provide access to consultants, accountants, lawyers, investment bankers, and other business that may acquire the startup company's product

- (d) Calculate the total compensation the venture capitalist will receive at the end of the first year.

Commentary on Question:

The candidates performed brilliantly on this section. Most candidates received full credit. A common mistake for those that did not receive full credit was to calculate the management fee using the \$30m of invested capital instead of the \$50m of committed capital. Partial credit was awarded in cases where candidates stated the correct formulas but made a calculation error.

Total Compensation = Management Fee + Incentive Fee

Management Fee = Management Fee Rate * Committed Capital = 2% * \$50m
= \$1m

Incentive Fee = Max[20% * Profits, 0] = 20% * \$6m = \$1.2m

Total Compensation = \$1m + \$1.2m = \$2.2m

- (c)

- (i) Assess which option is more likely to be chosen by the venture capitalist.
- (ii) Assess whether the venture capitalist's selection benefits ABC or is optimal for ABC.

Commentary on Question:

The candidates performed below average on this section. Many candidates correctly identified Option 2 as the strategy most likely to be chosen by the venture capitalist in (i). Some candidates did not provide any supporting calculations and thus received partial credit. Some candidates incorrectly concluded that the venture capitalist would most likely choose Option 1 solely due to its higher expected return, which doesn't consider the "free" call option on the profits. Partial credit was awarded in such instances, provided the underlying expected return calculations were correct. Additionally, many candidates noted that Option 2 was not beneficial to ABC in (ii), but again, some candidates did not provide any supporting calculations and thus received partial credit.

(i) Option 2 is more likely to be chosen by the venture capitalist because:

- *They will earn a 20% incentive fee on any profit the investment generates. The first option is expected to generate an incentive fee of $\$50m * 5\% * 90\% * 20\% = \$0.45m$, while the second option is expected to generate a greater incentive fee of $\$50m * 50\% * 20\% * 20\% = \$1m$.*
- *The venture capitalist's incentive fee income is similar to the payout of a call option on the profits. This means that the venture capitalist is encouraged to make riskier investments. The venture capitalist will not be penalized if the investment incurs losses (i.e. the call option is free).*

(ii) The venture capitalist's choice of Option 2 is not beneficial to ABC because it has a lower expected return.

- Option 2 has an expected return of $\$50m * 50\% * 20\% + \$50m * -20\% * 80\% = -\$3m$, while Option 1 has an expected return of $\$50m * 5\% * 90\% + \$50m * -5\% * 10\% = \$2m$.

- (d) Recommend covenants that ABC should include in the venture capital partnership agreements given the answer to part (c).

Commentary on Question:

The candidates performed below average on this section. Many candidates listed only one covenant, with the most common response being the clawback covenant.

Examples of recommended covenants are:

- **Clawback:** Previously paid incentive fees can be recouped at the end/liquidation of the fund if investors have not earned a profit.
- **Escrow Agreement:** Agreement where a portion of the incentive fees are held in a segregated account until the fund is liquidated. This ensures the venture capitalist does not walk away with profits unless the limited partners also receive profits.

Prohibition on distribution of profit-sharing fees to the venture capitalist until all committed capital is paid back to the limited partners: The limited partners must be

paid back their invested capital before profits are shared with the venture fund. A covenant such as this could also be extended to ensure that the limited partners receive all management fees before the venture capitalist can collect incentive fees.

19. QFI PM Fall 2023, Question 2

Learning Outcome(s): 1b

Source Materials: INV101-100-25: Chapters 3 and 4 of Alternative Investments: A Primer For Investment Professionals, CFA Institute

This question tested candidates' understanding of hedge fund characteristics and strategies. Generally, candidates performed below average for this question, primarily due to not attempting the question and not providing sufficient details to earn full credit.

Solution:

- (a) Calculate the beta of the short-selling hedge fund.

Commentary on Question:

Candidates performed poorly on this section. Some candidates were able to correctly calculate the beta and earn full credit. Several candidates either left the question blank or provided the total return instead of the beta of the fund.

Under exam conditions, it was acceptable to use both the Greek subset symbols as well as the written form below.

For 20XX (subscript A below):

$$\text{Beta}(\text{weightedA}) = \text{Beta-wA} = \frac{3}{8} * \text{Beta-marketA} + \frac{5}{8} * \text{Beta-HF} = \frac{3}{8} * 1 + (\frac{5}{8} * \text{Beta-HF})$$

$$r-A = r_f + \text{Beta-wA} * (r_{ma} - r_f) = 3.2\% + \text{Beta-wA} (8\% - 3.2\%) = 0.05 + 0.03 * \text{Beta-HF}$$

Similarly, for 20YY (subscript B below):

$$\text{Beta}(\text{weightedB}) = \text{Beta-wB} = 8/20 * \text{Beta-marketB} + 12/20 * \text{Beta-HF} = 0.4 + (0.6 * \text{Beta-HF})$$

$$r-B = r_{fb} + \text{Beta-wB} * (r_{mb} - r_{fb}) = 4\% + 6\% * (0.4 + (0.6 * \text{Beta-HF})) = 0.064 + (0.036 * \text{Beta-HF})$$

$r_A = r_B$ implies:

$$0.05 + 0.03 * \text{Beta-HF} = 0.064 + 0.036 * \text{Beta-HF}$$

$$\text{Beta-HF} = -2.33$$

Note Excel goal-seek may have been used to solve for the final value as well for full credit.

- (b) Recommend the most suitable hedge fund strategy for each investor.

Commentary on Question:

Candidates performed below average on this section. Some candidates deduced the optimal strategy using the investor details provided. Many candidates did not attempt this question or ignored some of these details, and recommended strategies that were inappropriate and/or inconsistent.

Investor A:

Global macro HF strategy meets all goals

- Lower fees than, for example, fund of funds, within the opportunistic HF strategy group
- Avoids idiosyncratic risk as in corporate restructuring strategies, and avoid event risk, as in convergence trading strategies
- Minimal leverage and broad market investing good in bull market, vs. arbitrage strategies

Investor B:

Equity long/short (in market-directional) or Market neutral (in convergence) HF strategy would work

- Directed investing can avoid international exposure and limit market exposure
- Directional view on sectors vs. individual stocks is obtained, unlike in other arbitrage strategies, such as relative value
- Net long position, vs. strictly short-selling

Investor C:

Market neutral HF strategy meets all goals

- Limited to alpha but not beta risk (found in market-directional strategies) and relies on manager skill instead
- Optimal with the convergence trading strategies, as it removes reliance on regression which statistical arbitrage applies
- Limits credit risk found in fixed income strategies
- Avoids opportunistic strategies since in a bear market

20. QFI PM Fall 2023, Question 3

Learning Outcome(s): 1b, 2k

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 18; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021: Ch 19: Portfolio Performance Evaluation

This question tests the candidate's understanding of private equity and its role in formulating an optimal portfolio allocation in a risk-return framework.

Solution:

(a) — ~~Define each of the above super asset classes, including an asset example for each class in your answer.~~

Commentary on Question:

~~The candidates performed as expected on this section. Some candidates provided correct examples for each asset class but did not provide the correct definition.~~

3. Continued

- ~~Capital assets: capital assets are defined by their claim on future cash flows of an enterprise and provide a source of on-going value.~~
 - ~~Stocks, bonds, financial derivatives~~
- ~~Assets used in economic inputs: physical assets that are consumed as part of the production cycle (i.e. consumable or transformable assets that can be converted to another asset).~~
 - ~~Grains, metals, energy products, livestock~~
- ~~Assets that store value: assets that are not associated with their claim on future cash flows and is a finished product.~~
 - ~~Art, gold and precious metals not used in the production of other goods~~

- (b) Explain the sources of risk premium that allow venture capital investors to earn returns in excess of public market investors.

Commentary on Question:

The candidates performed above average on this question. Most candidates were able to correctly identify additional sources of risk and how they translate to higher risk premiums for the investor.

- Venture capital investors take on business risk before a company has the ability to fully implement its business plan and therefore expect additional compensation compared to investing in public corporations.
- Liquidity is lacking for venture capital investments. There is no secondary market for trading venture capital interests. What secondary market exists is limited to other private equity investors.

- (c) Describe the common legal structures of typical U.S. private equity funds and their implications for defined benefit pension plan investments.

Commentary on Question:

Candidates performed poorly on this question. Many candidates confused the legal structure associated with private equity funds with the underlying strategy (e.g.,

leveraged buyout). Most candidates also did not comment on the impact the legal structure has for defined benefit pension plans.

Private equity funds usually funneled through a financial intermediary and are commonly structured as limited partnerships, limited liability companies or special purpose vehicles.

Investments in private equity funds are less liquid than their public counterparts, and therefore cannot be reliably used to fund benefit payments.

- (d) Recommend which portfolio to use.

Commentary on Question:

The candidates performed above average on this question. Most candidates were able to identify that both portfolios met the expected return objective. Some candidates were able to identify distressed debt has potential exposure to equity risk.

- Expected return of portfolio A = $20\% \times 3.5\% + 80\% \times 5.0\% = 4.7\%$
- Expected return of portfolio B = $20\% \times 3.5\% + 60\% \times 5.0\% + 20\% \times 7.0\% = 5.1\%$
- Both portfolios generate sufficient returns to keep pace with the liabilities.
- Distressed debt investors seek to invest in debt securities of distressed companies, with the objective of converting the cheap debt holdings to equity, turn the company around, and benefit from stock appreciation.
- Given the potential exposure to equity through distressed debt conversion, portfolio B does not achieve the second objective.
- Since only portfolio A achieves both objectives, it is recommended despite a lower Sharpe ratio overall.

21. QFI PM Fall 2023, Question 4

Learning Outcome(s): 1b

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 14

Refer to Excel file “INV101 LO1 Q21. QFI PM Fall 2023_Question 4”

22. QFI PM Fall 2023, Question 11

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 23

Candidates performed below average on this question. Most candidates exhibited limited knowledge of CMBS and RMBS. Many candidates responded with keywords without analyzing the specific situation presented in the question.

Solution:

- (a) Identify the differences in characteristics between commercial and residential real estate mortgage (excluding the property type).

Commentary on Question:

Candidates performed as expected on this part. Many candidates recalled the categories of differences but did not identify the actual difference.

Loan diversification: Commercial mortgage tends to be more diverse in the type of the properties. Residential properties are more homogenous.

Credit worthiness: For CMBS, risk management might involve focusing on the property's cash flow, tenant mix, and occupancy rates, as well as monitoring the overall commercial real estate market. For RMBS, risk management could include assessing the borrower's credit history, debt-to-income ratios, and loan-to-value ratios, as well as keeping an eye on the residential housing market.

Prepayment risk: CMBS usually have prepayment restrictions such as penalties and lockout periods. RMBS generally have fewer restrictions.

CMBS and RMBS are affected by different economic factors. CMBS are more sensitive to changes in the business cycle, interest rates, and commercial real estate market conditions. On the other hand, RMBS are more influenced by changes in consumer credit, employment, and residential housing market conditions.

- (b) Describe the credit quality of Tranches A and B relative to the underlying mortgages.

Commentary on Question:

Candidates performed poorly on this part. Most candidates responded correctly that Tranche A is safer, and Tranche B is more risky than the underlying mortgage. However, very few candidates provided an explanation on how this conclusion was reached.

Tranche A is a senior Tranche with 20% credit support.

Credit support = $\$5M \times 100 \times 20\% = 100M$.

Tranche A does not suffer any loss unless the total loss of the loan portfolio exceeds 100M. When a loan defaults, since the RR is 0.5, the LGD is \$2.5M.

Therefore, Tranche A does not suffer any loss unless more than 40 out of the 100 loans defaults.

Given the PD is 1% and loans are considered independent, the probability of more than 40 out of 100 default is virtually zero.

Tranche A is much safer than the underlying commercial mortgage portfolio, i.e. much less probability to suffer any loss.

Tranche B is only worth 100M (same as the credit support for Tranche A)

Tranche B will suffer the same amount of loss as the underlying mortgage since all losses under 100M goes to Tranche B.

Tranche B is riskier than the underlying commercial mortgage since the size of the underlying mortgage is \$500M.

- (c) Describe the risk factors to the investors in XYZ's CMBS under the current economic environment.

Commentary on Question:

Candidates performed poorly on this part. Many candidates did not identify the risk factors associated with the rise in interest rates.

Risk factors:

Higher interest rate leads to lower value of the underlying fixed rate commercial mortgages, increases the chance of default.

Re-financing risks: when the underlying commercial mortgage re-financing costs are higher.

Economic declines with the higher interest might cause hardship to the commercial tenant, leading to decreased cashflow of rents. Thus increasing the probability of default.

- (d) Recommend changes in future CMBS issues to mitigate the risks.

Commentary on Question:

Candidates performed poorly on this part. Most candidates identified only 0 or 1 of the risk mitigation strategies below.

Mitigation strategies:

Diversify the commercial mortgage pool to reduce concentration risks

Enhance underwriting criteria for the underlying commercial mortgage, lower LTV and higher debt service ratio etc

Offer more tranches and higher credit support – This enhances the credit rating for the senior tranches, against potential loss.

23. QFI PM Fall 2023, Question 12

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 22; INV101-102-25: High-Yield Bond Primer

This question tests how an institution must deal with specific risks associated with the cash flow of high-yield bonds and Collateralized Loan Obligation (CLO).

Solution:

- (a) Describe two additional reasons for this increase in popularity.

Commentary on Question:

The candidates performed poorly on this section. Only a minority of candidates were able to describe the reasons associated with the reluctance of traditional lenders such as banks to lend due to more strict regulations and an increase in liquidity risk with the Global Financial Crisis. Almost all candidates focused only on

the perception of risk reduction for liquidity, diversification and research of higher return for investors.

2 reasons other than yield-seeking institutional investors the increase in popularity for HY bonds and CLO are:

Liquidity risk in the short term affects the reluctance of banks to lend to corporates and motivate alternatives financing as High-Yield Bond and Collateralize Loan Obligations.

As banks retrenched after the Global Financial Crisis due to increased bank regulation and the reduction in risk appetite then greater demand for non-bank private debt.

(b) Describe the cash flow structures of the following instruments and how they impact the issuer and the pension plan:

- (i) ——— Deferred interest bonds
- (ii) ——— Step-up bonds
- (iii) ——— Payment-in-kind bonds
- (iv) CLOs

Commentary on Question:

~~The candidates performed above average on part (i) and part (ii) of this section. Most candidates were able to provide relevant explanations for the cash flow structures. However almost all candidates did not mention the impact on cash flow at issue. Partial credit was given to some candidates as they showed an understanding of the cash flow structures without correctly identifying the issuer or the pension plan.~~

~~The candidates performed above average on part (iii) of this section.~~

~~Most candidates were able to provide relevant explanation for the cash flow structures. Almost all candidates failed to mention the favorable impact on liquidity for the issuer and the risk on liquidity for the pension plan. Some candidates successfully described the credit risk and liquidity risk associated with the increase in bond value of the issuer.~~

~~The candidates performed as expected on part (iv) of this section.~~

~~Successful candidates identified a complete description of the cash flow from the pool of loans and the distribution that take account of the seniority.~~

~~However, all missed the fact that the CLO can call for funding.~~

(i) — ~~Deferred interest bonds~~
~~Issuers:~~

~~Receive less cash at issue since discounts.~~

~~Not pay coupons for an initial period of 3 to 7 years, after higher cash disbursements with a higher interest rate for coupons.~~

~~Investor:~~

~~Less cash needed at issue since discount.~~

~~No cash flow coupons for 3-7 years and higher coupons cash flow later.~~

(ii) — ~~Step-up bonds~~
~~Issuer:~~

~~Lower cash flows to pay since low initial coupon rate and higher cash outflows after an initial period.~~

~~Investor:~~

~~Lower cash flow from coupons for an initial period and higher after.~~

~~Need more cash than deferred interest bonds since no discount.~~

(iii) ~~Payment-in-kind (PIK)~~

~~Issuer:~~

~~Permit to keep its liquidity.~~

~~Option to pay coupons in cash or as a new bond with the same coupon rate with value equal to the value of the coupon.~~

~~Permit to keep its liquidity.~~

~~Investor:~~

~~For bond holders reduce projection of liquidity and increase bond value in the company and the credit risk associated with this company.~~

(iv) CLO:

Issuer:

CLO issue multiple debt tranches with equity and use the proceeds from the issuance to obtain a pool of loans.

Interest and principal cash flows generated from the collateral pool of loans are distributed to debt tranches and equity.

The cash flow distribution in prescribed ways that take into account the seniority of those debt tranche.

The CLO can call for funding when ready to invest.

Investor:

Invest into a specific debt tranche which carries specific risk/return based on credit quality, risk of loss and priority of cash flow distributions.

The debt holder received cash flow, according to seniority.

CLO can call for funding within some specified time period.

- (c) As an investor considering that high-yield bonds may provide higher yield, the financial risk profile of the company is an important determinant.

The risk manager mentions that an investment into senior debt of a CLO with the same yield as that of a high-yield bond appears more attractive, when considering diversification, risk appetite and liquidity in the case of default.

Justify the risk manager's statement.

Commentary on Question:

Candidates performed poorly on this question.

Justifications for all three risks were required to receive full credit. Only a few candidates provided explanations for each aspect. The main element candidates did well on is identifying a pool of loans provides diversification. Almost all candidates failed to provide adequate justifications for the risk appetite and the liquidity in case of default. Some candidates received partial credit for 'liquidity' by mentioning the cash flow distribution priority associated with senior tranches and with the 'risk appetite' with the choice of the CLO tranche by the investor with its risk appetite.

Diversification:

CLO avoid concentration of risk into a single company since invest into multiple loans then provide a form of diversification.

The CLO structure allows investors to purchase an interest in a diversified portfolio of loans.

Risk appetite:

The CLO provide a division and distribution of the risk of the CLO's assets to parties that have

different risk appetites.

High rating investors of CLO's and lower rating investors of CLO's share the same leveraged Loans with the same risk.

Liquidity in case of default:

The debt holder received cash flow, according to seniority.

In even of failure of the CLO, a par coverage test requires that cash be withheld from paying Interest on lower-ranking debt tranches. Instead, cash must be used to pay down the principal on the CLO's senior debt tranche.

The CLO provide subordination such junior tranches absorb losses before senior tranches.

- (d) A member of the board states that CLOs have a high risk of bankruptcy.

Critique this statement.

Commentary on Question:

The candidates performed poorly on this section. Successful candidates were able to explain that CLO cannot go into bankruptcy or is 'bankrupt remote'. Unsuccessful candidates focused mainly on the seniority of tranches to reduce bankruptcy. No candidate were able to identify that insolvency of the CLO's can not result from sins of the past, action of other creditor or bankruptcy of any other entity.

CLO cannot go into bankruptcy, either voluntarily or through the action of an aggrieved creditor.

CLO will not be caught up in the bankruptcy of any other entity.

CLO Cannot have any legal liability for sins of the past.

If the CLO is insolvent, the conditions have already been determined in detail at the origination of the CLO.

24. QFI PM Spring 2024, Question 3

Learning Outcome(s): 1b

Source Materials: INV101-100-25: Chapters 3 and 4 of Alternative Investments: A Primer For Investment Professionals, CFA Institute

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

Solution:

Your students ~~made the following comments about the~~ identified the following risks faced by hedge funds:

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

Explain each risk.

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.

Complexity risk – investing in securities and structures, including embedded options.

Illiquidity risk – hedge funds may invest in small cap or unlisted stocks, or assets with regulatory restrictions

Event risk – hedge funds may only earn excess returns if a specific event occurs (for example, finalization of a merger)

- (a) 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.

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 = $\$42 + \$40 \times 25\%$. 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.

25. QFI PM Spring 2024, Question 4

Learning Outcome(s): 1b

Source Materials: The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011, Ch 19

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
- 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.

- Equity investment = \$500 million - \$300 million = \$200 million
- $(\text{Sale price}/\text{Equity investment})^{(1/\text{Investment Period})} - 1 = \text{Target Annual Compound Return}$
- 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

26. QFI PM Spring 2024, Question 5

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 23

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

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.

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 \text{ million} \times 100 \times 75\% = \37.5 million . Since a total prepayment of \$18.75 million ($25 \times \$0.5 \text{ million} + 25 \times \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.

27. QFI PM Fall 2024, Question 2

Learning Outcome(s): 1a

Source Materials: INV101-101-25: Overview of Investing in Private Corporate Debt; INV101-102-25: High-Yield Bond Primer

Candidates performed as expected for this question, especially on parts a) and b).

Solution:

- (e) Compare in terms of return, risk, market, and cash flow characteristics each of the following as they relate to investment grade bonds.
- (i) Private debt funds
 - (ii) High yield bonds

Commentary on Question:

Overall, candidates did better on part (ii) than part (i). For the part (i), many candidates were able to get credit for the risk and market aspects. However, very few candidates successfully explained risk and cash flow characteristics. For part (ii), most candidates got partial credit for the risk and return, and many candidates got credit for the market and cash flow too. Candidates needed to mention at least one key point listed in the answers for each term to get the full credit.

Private Debt Funds

- Return: Higher Yield compared to IG bonds
- Risk: Default rate and Recovery rate highly depends on the skills, due diligence and monitoring of the GPs. On average, it is lower default and higher recovery rates than public bonds

- Market: Invest through partnership. Not traded in public. Not rated. Lack of transparency. GPs control all the investment decisions
- Cash Flow: Loan coupon and principal. Early repayment penalties. portfolio company's fees. Investments on the secondary markets

High-Yield Bonds

- Return: Higher Yield compared to IG bonds
- Risk: Higher default, higher credit risk than IG bonds
- Market: Traded in public market. Below investment grade bond rating. More transparency – required by the regulators.
- Cash Flow: Debt coupon rate and principal. Bond structure may be fixed term/fixed coupon rate or flexible such as deferred interest bonds, step-up bonds, Payment-in-kind bonds.

- (f) Recommend which of these two assets to add to the portfolio.

Commentary on Question:

Candidates performed as expected for this question. Many candidates made the correct recommendation and earned at least partial scores for the explanations. Candidates who did not receive full credit did not provide enough support for their recommendation.

High yield bond is recommended for this block of business.

- Both assets can improve the overall return of the portfolio since they have higher return than IG bonds.
- Both assets can provide consistent cash flow that fit the liabilities
- However, the credit risk of the private debt fund is harder to manage as it is less transparent and highly depends on the skills and due diligence of the GPs of the private debt funds
- Private debt fund is regarded as illiquid as they are not traded in public market and investment period ends when GP exists investments and distributes all proceeds to investors (LPs)

- The default information of High yield bonds is more readily available
- High yield bond is more liquid as it is traded in public market

(c) ~~An analyst on the asset management team suggests selling credit default swaps (CDS) with reference to high yield bonds instead of investing in high yield bonds directly. This would limit the cash outflow and eliminate interest rate risk.~~

~~Critique the analyst's suggestion.~~

Commentary on Question:

Candidates performed below average for this question. Many candidates explained the credit risk exposure and some candidates mentioned the cash flow characteristics. Some candidates failed to understand the interest rate risk impact correctly. Very few candidates mentioned the counterparty risk. Candidates needed to cover all four aspects to get the full score.

- ~~Both instruments are exposed to the credit risk of the reference bond~~
- ~~CDS sellers have less cash outflow compared to bond investors. Both investors receive regular cash payments while bond investors need to pay principal and repayment at the start and end of the term. Sellers of CDS only have cash outflow in the event of default of the reference bond.~~
- ~~CDS is a swap. It introduces counterparty risk to the portfolio (a more modern reference may refer to central counterparty risk)~~
- ~~CDS does not eliminate interest rate risk. The present value of the loss payment leg or the premium leg are sensitive to interest rate fluctuation.~~

28. QFI PM Fall 2024, Question 13

Learning Outcome(s): 1b

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 12

This question tests the student's understanding of Real Estate as an alternative investment, including but not limited to the differences between the RE market and typical securities; differences between two levels of asset markets relevant for RE investments; and special characteristics of RE and how investors make decisions on RE investments.

Solution:

- (a) Describe two characteristics that differentiate the real estate market from the typical securities investment environment.

Commentary on Question:

Most candidates performed worse than expected on this question. Many candidates earned credit for mentioning market and information inefficiency. However, many seemed to misunderstand the question, and forgot about the two levels of asset markets relevant to the RE market and gave characteristics of physical assets only.

- A well-functioning market usually exists for the underlying physical assets that are being considered, namely, commercial buildings.
 - The commercial RE asset market is not as informationally efficient.
 - There are two levels of asset markets relevant for real estate investment (private RE asset market and publicly traded REIT shares in the stock exchange)
- (b) Analyst A highly recommends direct investment in properties because:
- the company can take advantage of the predictability to buy low and sell high with extensive research and

- there are greater opportunities for making successful market timing decisions.

Evaluate analyst A's comments.

Commentary on Question:

Candidates performed as expected on this section. Most students were able to identify the limitations in Analyst A's comment and gave proper explanations but only a few of them were able to get full credit and stated sufficient details.

Final conclusion: Do not agree with Analyst A's comment.

Reasons:

- Real estate markets are far from fully predictable – though asset prices move more slowly in response to news, and thus only partially adjusting in a short/medium time horizon.
- Transaction costs in buying and selling assets in the direct property market are much greater than in the securities market and can easily remove much of the profit investors could otherwise obtain from trading on predictable asset movements.
- Transaction costs can be mitigated by holding RE investment for long periods of time, but long holding periods also mitigate the per-annum percentage profit that can be earned from timing the volatility of the markets.
- Investment returns over long holding periods are often more sensitive to how well the property is managed than to the timing of the transactions.

- (c) Contrast the quantification of REIT NAVs and REIT share prices.

Commentary on Question:

Candidates performed much worse than expected on this question. Many earned partial credit for mentioning REIT share prices and future growth. However, many students confused the definition of REIT NAVs and REIT share prices.

- NAVs are based on existing property values
- NAVs are based on private market valuations
- debt liabilities need to be removed to arrive at the NAV
- REIT share prices consider future growth opportunities

- (d) Assess whether REIT Company C can afford to pay a higher price for a given property than REIT D based on the above two metrics.

Commentary on Question:

Candidates performed poorly on this question. Most students were able to mention that these two metrics were not sufficient to reach the conclusion. However, they did not provide sufficient support for their conclusion.

Neither company level cost of capital nor company's earnings yield has a causal relationship with the OCC when evaluating investment value of a specific property.

The OCC for evaluating a given property should reflect the risk in the property, while both metrics mentioned above are at company level.

- The cost of capital of a company is an average based on the company's current holding, and is different from the marginal cost of capital of the new property.
- A higher P/E ratio means that a stock's price is higher relative to earnings and possibly overvalued. Investors may use this metric to determine a stock's market value and future earnings growth of a company

However, REIT Company C may be able to afford to pay a higher amount due to other metrics, for example, it may have a higher Investment Value to the company (e.g. tax benefits, synergies with the existing property holdings and etc.).

29. QFI PM Fall 2024, Question 14

Learning Outcome(s): 1a

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 16; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 23

This question is intended to test the candidate's understanding of the concepts underpinning the underlying loans backing the CMBS, the hierarchy of CMBS payments, the risk characteristics of each tranche within the hierarchy structure, and the challenges faced by the CMBS industry. To earn full credit, candidates needed to demonstrate an understanding of residential versus commercial mortgages, the CMBS securitization process, the risk-return profile of CMBS tranches, and how moral hazard and adverse selection impact CMBS. The most successful candidates were able to provide a comprehensive list with proper explanation for parts (a) and (b), identify the key characteristics of each tranche and how they affect the risk-return profile of the enterprise for part (c), and clearly define moral hazard and adverse selection in general and in the context of CMBS.

Solution:

- (a) Identify four differences between residential and commercial mortgages.

Commentary on Question:

Candidates performed above average for this part. Most candidates were able to list at least two differences with proper explanation to receive partial credits. Full credit was given if four differences are identified.

- Individual residential loans are much smaller on average, but much more numerous than commercial loans.
- Residential owner-occupied properties generate no income, so the lender depends on the individual borrower's income to service the loan, while commercial loans can be serviced from the income produced by the property securing the debt.
- Residential borrowers are usually not financial or business professionals and are typically in the market for a loan only occasionally, while commercial borrowers are typically commercial or financial entities staffed by business professions with much greater expertise than the typical homeowner.
- Commercial properties tend to be more unique, while single-family homes tend to be relatively homogeneous.
- Social and political concerns, and the resulting government involvement, are much greater regarding residential loans than commercial loans, including different statutory and common laws governing foreclosure and bankruptcy for residential versus commercial loans.

(b) Describe key players in the CMBS securitization process.

Commentary on Question:

Candidates performed as expected for this part. Few candidates were able to identify steps in the securitization process and list the corresponding key players. Some candidates received credit for providing a proper explanation of the key player without correctly naming it or for giving a name without complete explanation.

- Mortgage borrowers are provided mortgage loans by Lenders.
- Lenders sell the individual mortgage loans to investment banks.
- Investment banks package the loan and transferred to a Trust.
- The Trust issues and sells classes of bonds, also known as tranches, to Investors.
- Investors receive cash flows from the mortgage loans depending on the claim assigned by the tranche.
- Servicers collect cash flows from the mortgage borrowers, deal with defaults, and receive a portion of the mortgage cash flow for their servicing.

- (c) Critique the appropriateness of each of the above tranches that ABC Insurance Co. is considering adding to its investment portfolio.

Commentary on Question:

Candidates performed below average for this part. Most candidates were able to identify Tranche A as the senior and protected tranche, but only a few identified the diversification benefit. Many candidates incorrectly stated that the IO strip is junior to Tranche B, and only a few mentioned the volatile duration of the IO strip. Candidates received partial credits for identifying key characteristics of each tranche but failed to recommend Tranche A.

- Tranche A, as a senior tranche, receives priority cash flows and is also protected from default by the lower Tranches, such as Tranche B.
- While Tranche B has a higher coupon, the additional risk associated with default is too risky for a Life Insurance Company.
- The IO strip is a possible option and gives an interest-only return for the duration of the CMBS, but the coupon for this strip is lower and the investment duration could be highly variable.
- Tranche A is appropriate for a Life Insurer as additional diversification for the current portfolio.

- (d) Describe moral hazard and adverse selection and how they create challenges for the CMBS industry.

Commentary on Question:

Candidates performed as expected for this part. Most candidates successfully identified the moral hazard or adverse selection in the context of CMBS, but only a few were able to describe both and provide a clear definition to receive full credit.

- Moral hazard exists when one party has control over an action or decision that affects the risk of well-being of another party.

- Adverse selection occurs when a relevant sample or selection tends to have unfavorable characteristics compared to the average characteristics in a population.
- An example of moral hazard could be if loan issuers determine the amount of risk in the loans, they issue by underwriting standards they employ, but then immediately pass that risk on to other parties.
- An example of adverse selection could be if CMBS are viewed by the bond market as being riskier and require higher yields, which in turn requires borrowers of CMBS loans to pay higher interest rates, and so the best borrowers and loans go to competing non-CMBS types of lenders.

30. QFI PM Fall 2021, Question 14

Learning Outcome(s): 1a

Source Materials: Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021 Ch 11

ABC life insurance is considering applying for a syndicated leveraged loan.

(parts a, b and c are no longer covered by the syllabus)

(d) Describe three purposes that common covenants in a leveraged loan obligation serve.

Commentary on Question:

The candidates performed below average on this section. Candidates received partial credit for the main points, while those candidates that elaborated on the relevant sub points received full credit.

- Preservation of capital – not just of existing assets but those acquired as well.
- Appropriateness of excess capital – cash flows from excess capital should be used to repay loans.
- Business risk – curb the borrower's ability to make business decisions that benefit equity holders before lenders.
- Performance requirements – tracking against coverage ratios, leverage ratios, etc.

- Reporting requirements – require budgets, projections, and other internal reports.

INV 101

LEARNING OBJECTIVE 2

ILLUSTRATIVE SOLUTIONS

These Illustrative Solutions are meant to demonstrate the level of knowledge to earn full credit on each Sample Question. They are not meant to depict a perfect solution, and candidates are encouraged to review the relevant Source Materials in conjunction with the solution as provided.

Illustrative solutions have been modified to reflect the current Syllabus. In the case where any part of the solution is no longer contained within the current Syllabus the old solution is struck through (for example, ~~this part of the solution is no longer valid~~). Where the current Syllabus differs from the prior but can be used to answer the question the modified solution is indicated in **blue font**.

Table of Contents

1. QFI PM Fall 2020, Question 5	9
Learning Outcome(s): 2l, 2h.....	9
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch7, Ch 13	9
2. QFI PM Fall 2020, Question 10	12
Learning Outcome(s): 2b	12
Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute	12
3. QFI PM Fall 2020, Question 11	15
Learning Outcome(s): 2i, 2j, 2k	15
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch7, Ch 19	15
4. QFI PM Fall 2020, Question 15	18
Learning Outcome(s): 2j, 2k	18
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19	18
5. QFI PM Spring 2021, Question 1	21
Learning Outcome(s): 2g, 2h, 2j	21
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 12, Ch 13, Ch 19	21
6. QFI PM Spring 2021, Question 2	24
Learning Outcome(s): 2f, 2k	24
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 10, Ch 19.....	24
7. QFI PM Fall 2020, Question 10	28
Learning Outcome(s): 2k	28
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19	28
8. QFI PM Fall 2020, Question 16	31
Learning Outcome(s): 2d, 2f	31

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6, Ch 10	31
9. QFI PM Fall 2021, Question 1	35
Learning Outcome(s): 2j, 2k.....	35
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19	35
10. QFI PM Fall 2021, Question 2	38
Learning Outcome(s): 2f.....	38
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 10	38
11. QFI PM Fall 2021, Question 8	41
Learning Outcome(s): 2h, 2k.....	41
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 13, Ch 19.....	41
12. QFI PM Fall 2021, Question 12	44
Learning Outcome(s): 2d	44
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6.....	44
13. QFI PM Fall 2021, Question 13	48
Learning Outcome(s): 2b, 2d.....	48
Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6	48
14. QFI PM Spring 2022, Question 3	53
Learning Outcome(s): 2i, 2k.....	53
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19	53
15. QFI PM Spring 2022, Question 6	57
Learning Outcome(s): 2k, 1b.....	57
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19;The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011 Ch 10, Ch 18 ...	57

16. QFI PM Spring 2022, Question 9	60
Learning Outcome(s): 2b, 2c, 2d	60
Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 6	60
17. QFI PM Spring 2022, Question 16	62
Learning Outcome(s): 2f	62
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 10	62
18. QFI PM Fall 2022, Question 2	65
Learning Outcome(s): 2i, 2k	65
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19	65
19. QFI PM Fall 2022, Question 3	67
Learning Outcome(s): 2k	67
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19	67
20. QFI PM Fall 2022, Question 6	69
Learning Outcome(s): 2e	69
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 9	69
21. QFI PM Fall 2022, Question 13	72
Learning Outcome(s): 2k	72
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 19	72
22. QFI PM Fall 2022, Question 17	75
Learning Outcome(s): 2b	75
Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors	75
23. QFI PM Spring 2023, Question 1	78
Learning Outcome(s): 2e, 2f	78

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 9, Ch 10	78
24. QFI PM Spring 2023, Question 4	83
Learning Outcome(s): 2f	83
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 10	83
25. QFI PM Spring 2023, Question 7	86
Learning Outcome(s): 1b, 2l	86
Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 12, Ch 14; INV101-105-25: Addressing Built-in Biases in Real Estate Investment.....	86
26. QFI PM Spring 2023, Question 8	91
Learning Outcome(s): 2j, 2k	91
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19	91
27. QFI PM Spring 2023, Question 11	93
Learning Outcome(s): 2d, 1b	93
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6; Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014 Ch 12	93
28. QFI PM Fall 2023, Question 6	96
Learning Outcome(s): 2b	96
Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors;.....	96
29. QFI PM Fall 2023, Question 7	99
Learning Outcome(s): 2e	99
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 9, Ch 10	99
30. QFI PM Fall 2023, Question 8	104
Learning Outcome(s): 2d, 1b	104

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 6; Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014 Ch 12, Ch 14	104
31. QFI PM Fall 2023, Question 10	107
Learning Outcome(s): 2d, 2e, 2f	107
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 6, Ch 9, Ch 10	107
32. QFI PM Fall 2023, Question 13	113
Learning Outcome(s): 2i, 2j, 2k	113
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19	113
33. QFI PM Spring 2024, Question 2	118
Learning Outcome(s): 2g	118
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 12	118
34. QFI PM Spring 2024, Question 6	121
Learning Outcome(s): 2c, 2k	121
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 19	121
35. QFI PM Spring 2024, Question 7	126
 Learning Outcome(s): 2g	126
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2003 Ch 12	126
36. QFI PM Spring 2024, Question 8	130
Learning Outcome(s): 2b, 2j, 2k	130
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19; INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute	130
37. QFI PM Spring 2024, Question 14	134
Learning Outcome(s): 2b, 2c, 2d	134

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 6; INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute.....	134
38. QFI PM Fall 2024, Question 4	141
Learning Outcome(s): 2d, 2k.....	141
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6, Ch 19	141
39. QFI PM Fall 2024, Question 5	144
Learning Outcome(s): 2g, 2h, 2k	144
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 12, Ch 13, Ch 19; INV101-104-25: The Hidden Dangers of Passive Investing	144
40. QFI PM Fall 2024, Question 7	150
Learning Outcome(s): 2a, 2b, 2c	150
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5; INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute.....	150
41. QFI PM Fall 2024, Question 8	152
Learning Outcome(s): 2i, 2j, 2k	152
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19	152
42. QFI PM Fall 2024, Question 9	156
Learning Outcome(s): 2g	156
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 12	156
43. QFI PM Fall 2024, Question 12	159
Learning Outcome(s): 2f.....	159
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 10	159
44. ILA LAM Fall 2023, Question 4.....	162
Learning Outcome(s): 2a	162

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5.....	162
45. ILA LAM Fall 2023, Question 4.....	165
Learning Outcome(s): 2b, 2c, 2d	165
Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 6	165
46. ILA LAM Fall 2024, Question 5.....	170
Learning Outcome(s): 2c, 1b.....	170
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5; Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014 Ch 12, Ch 14; The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011; Handbook of Fixed Income Securities, Fabozzi, Frank J., 9th Ed Ch 10, Ch 22	170
47. QFI PM Fall 2022, Question 4	175
Learning Outcome(s): 2d, 2j, 2k	175
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6, Ch 19	175
48. QFI PM Spring 2023, Question 5	178
Learning Outcome(s): 2k	178
Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19	178

1. QFI PM Fall 2020, Question 5

Learning Outcome(s): 2l, 2h

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch7, Ch 13

This question tests the understanding of behavior biases displayed by finance professionals in portfolio management decisions. Overall, the candidates performed as expected on this question.

Solution:

- (a) Describe three behavioral biases your advisor may be displaying.

Commentary on Question:

The candidates performed as expected. Answers that correctly identified the biases, provided correct descriptions, and related the biases to the context presented received full credit. Candidates received credit for all well-structured reasonable answers based off the syllabus content. Unsuccessful candidates named the biases without any supporting description, while others mixed up concepts between different biases.

~~Heuristics: Finance professionals tend to exclude specific information or process information incorrectly when advising clients. This situation is associated with a cognitive tool of decision-making in which individuals apply heuristics or mental shortcuts when processing large amounts of data or statistics that often result in mental mistakes. The advisor is using the shortcut of "20%" based on historical information. There is no guarantee that the heuristic would hold true this time around and he didn't attempt to analyze all the information available in the market.~~

Representativeness, or recency, bias is the tendency to overweight the importance of the most recent observations and information relative to a longer-dated or more comprehensive set of long-term observations and information. It is believed that asset prices largely follow a random walk; past prices cannot be used to predict future returns. If this is true, then shifting the asset allocation in response to recent returns, or allowing recent returns to unduly influence the asset class assumptions used in the asset allocation process, will likely lead to sub-optimal results.

Loss Aversion: Loss-aversion bias is an emotional bias in which people tend to strongly prefer avoiding losses as opposed to achieving gains. A number of studies on loss aversion suggest that, psychologically, losses are significantly more powerful than gains. The utility derived from a gain is much lower than the utility given up with an equivalent loss. This behavior is related to the marginal utility of wealth, where each additional dollar of wealth is valued incrementally less with increasing levels of wealth. ~~Portfolio managers may overweight losses compared to an equivalent gain relative to a reference point or anchor, and their behaviour depends on which side of the point their position lies. This behaviour results in the disposition effect in which professionals recommend retaining securities too long in order to recoup losses. The advisor recommended against selling based on the rationale that as long as you keep holding the position, no loss would be realized. This may not be the optimal move in the portfolio management process and could end up a costly mistake.~~

The illusion of control is a cognitive bias—the tendency to overestimate one's ability to control events. It can be exacerbated by overconfidence, an emotional bias. If investors believe they have more or better information than what is reflected in the market, they have (excessive) confidence in their ability to generate better outcomes. They may perceive information in what are random price movements, which may lead to more frequent trading, greater concentration of portfolio positions, or a greater willingness to employ tactical shifts in their asset allocation.

~~Anchoring is the tendency for experts to have a belief and then apply it as a reference point for making future judgments. Because finance practitioners often base their decisions on the first piece of information they receive such as a stock's initial purchase price, they have difficulty modifying their assessment to new information. The advisor referred back to his purchase for another client five years ago. Back then he may have done good analysis but it'd be hard to believe that nothing has changed since then. The advisor is anchoring to the first piece of information he had on the company.~~

- (b) Explain how the behavior biases of institutional investors could have contributed to AAA's rapid price change.

Commentary on Question:

The candidates performed below average on this part. Many candidates successfully identified at least one bias. Unsuccessful candidates named biases without providing any explanations relating to the question.

~~Herding behavior: Institutional investors display a propensity to herd or to follow each other's trades. They infer information from each other's trades. They also analyze similar information and draw the same conclusions about the fair values of specific securities. As some institutions began to sell AAA for some reason, more institutions likely followed suit, pushing the prices lower.~~

~~Momentum Trading: Momentum trading refers to an investment strategy that tries to benefit from the continuance of existing market trends. As AAA began to tend down, the momentum traders would have followed the trend to sell and push the prices even lower.~~

- (c) Calculate your manager's misfit risk.

Commentary on Question:

The candidates performed as expected. Many candidates received full credits for successfully completing the calculation. Those who wrote down correct formulas and/or intermediate steps received partial credits even if the final solution was incorrect. A notable number of candidates used a wrong formula to calculate the misfit risk.

Manager's true active return = Manager's return – Manager's normal benchmark = 10% - 15% = -5%

Manager's true active risk = Manager's true active return / Information Ratio
= -5% / -1.118 = 4.47%

Manager's misfit risk² = Manager's total active risk² – Manager's true active risk² = 6%² – 4.47%²

Manager's misfit risk = 4%

2. QFI PM Fall 2020, Question 10

Learning Outcome(s): 2b

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute

This question tests the application and effectiveness of an Investment Policy Statement for two very different investors.

Solution:

- (a) Outline the scope and purpose of an IPS.

Commentary on Question:

Candidates scored below average on this question. Many candidates failed to outline the scope and purpose of an IPS but instead provided general risk management practices.

Define the Investor

- Define who the investor is
- Specify which of the investor's assets are to be governed by the IPS

Define the Structure

- Set forth key responsibilities and actors
- Identify an organization structure for investing
- Identify a risk management structure applicable to investing
- Assign responsibility for monitoring and reporting
- Document acceptance

- (b) Compare and contrast IPS investment objectives between the two clients.

Commentary on Question:

Candidates scored above average on this question in general. Many candidates only analyzed one of risk or return objectives and received partial credit. A few candidates received full credit for discussing each of the bullet points shown below.

- Investment objectives are return and risk

- Return for Life insurer determined by rates used for reserves
 - Return for wealthy couple determined by individual circumstances, but in this case long term growth appears to be the objective
 - Risk tolerance for Life insurer is low due to regulatory and rating agency constraints
 - Risk tolerance for wealthy couple appears to be high
- (c) Explain governance considerations to be included in the insurance company IPS.

Commentary on Question:

Candidates scored below average on this part of the question. Most candidates answered general risk management practices (and received partial credit) but not governance considerations to be included in the IPS.

Responsibility for determining and executing investment policy.

Documents accountability for all stages of investment policy development

Example: Board of Directors Investment Committee is responsible for determining

Process for reviewing and updating IPS.

Process for refreshing IPS as investor circumstances or market conditions change should be clearly identified in advance

Example: Each Investment Committee meeting will have an agenda item for reviewing market conditions or proposed changes

Responsibility for engaging and discharging external advisers

IPS should state who is responsible for hiring/firing external money managers, consultants, or other vendors

Example: Investment Committee delegates to Chief Investment Officer responsibility for hiring/firing external managers, etc.

Description of roles and responsibilities of boards and staff

The roles and responsibilities for oversight boards and management staff should be identified in the IPS

Example: Investment Committee responsible for setting, approving, and reviewing policies, etc.

Responsibility for determination of asset allocation

Having an asset allocation framework, as direct part of IPS or appendix, provides strategic context for tactical decisions

Example: Asset Allocation plan documents Investment Committee's expected equity, fixed income, etc. return assumptions

Responsibility for risk management, monitoring, and reporting

The IPS should document who is responsible for setting risk policy, monitoring the risk profile, and reporting on portfolio risk

Example: Chief Financial Officer responsible for executing risk management policies

- (d) Compare and contrast investment constraints between the two clients.

Commentary on Question:

Candidates performed above average in this part of the question. Many candidates answered less than four constraints and only received partial credit but almost every candidate provided at least one of the constraints.

Liquidity requirements for insurer depends on regulations and liabilities. For the wealthy couple, liquidity may be needed for philanthropic efforts, but not for passing wealth on to heirs.

Time horizon for insurers is based on when liabilities are due. For the wealthy couple, time horizon is very long, depending on their age and health.

Tax considerations for insurers will likely be very different from individual.

Regulatory and legal – many constraints from insurers from NAIC, states, tax regs, concentration of holdings, etc. Far fewer regulatory and legal constraints for individual investors

Unique needs and preference – will be very difference between the two investors

3. QFI PM Fall 2020, Question 11

Learning Outcome(s): 2i, 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch7, Ch 19

This question tested the knowledge of benchmark portfolios and the returns of different investment styles when compared to those benchmark portfolios.

Solution:

- (a) Evaluate the properties of the proposed benchmark in comparison to an ideal benchmark.

Commentary on Question:

The candidates performed below average on this section. Some candidates received full credit for the answers they provided. Many candidates, while receiving partial credit for providing the qualities of an ideal benchmark did not provide sufficient explanations of why the proposed benchmark is not ideal.

An ideal benchmark has the following qualities:

- Investable
- Measurable
- Unambiguous
- Specified in Advance
- Reflective of current investment opinions
- Accountable
- ~~Consistent with managers options~~
- ~~Owned by the manager.~~

The proposed benchmark has a number of flaws that do not meet the criteria for an ideal benchmark:

- The benchmark is not investable. Cannot invest in the top quartile of peer group because that is not known until after
- Not specified in advance. Cannot know the top quartile until after
- It is an ambiguous benchmark because there is subjectivity in determining what is included in the “peer group”
- ~~The benchmark suffers from survivorship bias because only the funds that perform well will still be around at the end. Poor performing funds will be shut down.~~

- (b) Calculate XYZ Investment Management’s return due to both style and active management.

Commentary on Question:

The candidates performed below average on this section. Some candidates received full credit for their answers. Many candidates did not document where the values came from or the underlying formulas used.

Market Return = Russell 3000 Index = 25.2%

Style Return = (Russell 1000 Value Index – Market Return) = (21.7% - 25.2%) = -3.5%

Active Return = (Actual Return – Benchmark) = (23.5% - 21.7%) = 1.8%

- (c) Interpret your results for both style and active management.

Commentary on Question:

The candidates performed below average on this section. Some candidates received full credit for their answers on this section. Some candidates did not provide appropriate interpretations given their responses to part b.

The style return is negative which means that the particular style that the investment manager employs underperformed the market during the period.

However, the active return is positive which means that the manager outperformed his style benchmark and added value through active management.

Even though the actual return underperformed the market, the active manager still added value through active management because he outperformed his benchmark.

- (d) Determine which manager has the lower chance of outperforming the benchmark.

Commentary on Question:

The candidates performed below average on this section. Most candidates received partial credit for being able to calculate the Information Ratio for both ABC and DEF. Some candidates received partial credit for their explanations of the values from the table that they had used. Many candidates received no credit for only pulled single values from the table rather than values from each of the durations given.

The information ratio= active return/active risk.

For ABC, $IR = 1.5\% / 2.24\% = 0.67$

For DEF, $IR = 4\% / 10\% = 0.4$

From the table, we know the probability of DEF ($IR = 0.4$) is lower than that of ABC ($IR = 0.67$) for all years 1 to 20.

So, DEF has the lower chance to outperforming the benchmark.

- (e) Your colleague recommends DEF Equities over ABC Equities, based only on ABC's lower annual value-added return when compared to DEF.

Explain the shortcomings of your colleague's recommendation.

Commentary on Question:

The candidates performed poorly on this section. Many candidates did not mention either Qualitative criteria or costs of manager turnover.

My colleague is only considering the additional return DEF offers, but is not considering the additional risk, or the change that each fund actually outperforms the benchmark (in other words, actually provides active management value). Thus, while DEF has a higher average value added

return, this return comes with significantly more risk. Also, as determined in part (d), DEF actually has a lower chance of outperforming the benchmark at each year

In summary, average annual value added return is a single metric and no single metric can perfectly tell you what the right investment is. Thus, we should also take into account variability of returns, information ratio, and probability of outperforming benchmark, all of which favors ABC

4. QFI PM Fall 2020, Question 15

Learning Outcome(s): 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

This question tests candidates' understanding of the theory and techniques of equity portfolio management. Candidates performed as expected on this question.

Solution:

- (a) Evaluate the performance of each individual manager and overall portfolio based on the trade-off between active return and tracking risk.

Commentary on Question:

Candidates performed as expected on this part. Many candidates were able to evaluate the performance of each individual manager. A few candidates evaluated the overall portfolio and/or calculated the overall portfolio's active return and tracking risk, and only those candidates were awarded full credit for this part.

Manager A: contributes positive active return, but higher active risk than other two managers

Manager B: looks to be the best performer among the three, as he contributes more active return than active risk to the overall portfolio

Manager C: does not contribute active return nor active risk than the benchmark and looks he just manages an index fund

Portfolio active return

$$\begin{aligned} &= \left(\frac{200}{200 + 100 + 400} \right) \times (2\%) + \left(\frac{100}{200 + 100 + 400} \right) \times (3\%) \\ &\quad + \left(\frac{400}{200 + 100 + 400} \right) \times (0\%) \\ &= 1\% \end{aligned}$$

Portfolio tracking risk

$$\begin{aligned} &= \left[\left(\frac{200}{200 + 100 + 400} \right)^2 \times (4\%)^2 + \left(\frac{100}{200 + 100 + 400} \right)^2 \times (5\%)^2 \right. \\ &\quad \left. + \left(\frac{400}{200 + 100 + 400} \right)^2 \times (0\%)^2 \right]^{0.5} \\ &= 1.35\% \end{aligned}$$

- (b) Evaluate the investment style and strategy of Manager B.

Commentary on Question:

Candidates performed above average on this part. Most candidates were able to identify the investment style and strategy, and also give an explanation for it.

Investment strategy: active return investment

- because both the active return is bigger than 2% and tracking risk is greater than 4%.

Investment style: value investing because of the following reasons:

- He invests in securities having a P/E lower than the benchmark
- He invests in securities having a P/B lower than the benchmark
- He invests in securities having a dividend yield higher than the benchmark

- (c) Describe the structure of the overall portfolio.

Commentary on Question:

Candidates performed above average on this part. Most candidates correctly identified the approach, and also correctly identified the reason for it.

The managers' portfolios represent a **core-satellite portfolio**.

Manager C has an indexed investment, which represents more than half the portfolio's value and acts as a core.

Other actively managed portfolios represent the satellite portfolios surrounding the core.

- (d) Compare and contrast these two analyses.

Commentary on Question:

Candidates performed as expected on this part. Many candidates did not give a definition of the two style analyses. Most candidates provided a few characteristic of each of the two analyses.

Compare and contrasts of the two style analyses

	Return-Based	Holdings-based
Definition	it involves regressing the portfolio returns on the return series of a set of security indices.	it categorizes individual securities by their characteristics and aggregates results to reach a conclusion about the overall style of the portfolio at a given point in time.
	It characterizes the entire portfolio	Characterizes by each individual position
	It facilitates portfolio comparison	Facilitate individual position comparison
	It may be ineffective in characterizing current style	may capture changes in style more quickly than returns-based analysis in looking at the present
	Requires minimum information	It is more data intensive
	More cost effective and can be executed quickly	
	Different models usually give largely similar results and portfolio characterizations	It requires specification of classification attributes for style; different specifications may give different results.

	Errors in specifying indices in the model may lead to inaccurate conclusions	Does not have to specify any underlying indices
	It is a clear theoretical basis for portfolio categorization	

5. QFI PM Spring 2021, Question 1

Learning Outcome(s): 2g, 2h, 2j

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 12, Ch 13, Ch 19

Solution:

- (a) Define passive, active, and semi-active equity investing.

Commentary on Question:

The candidates performed very well on this section. They demonstrated an understanding of the basic concepts surrounding passive, active, and semi-active investing that was in line with the level expected.

-Passive: The investor is not expressing his investment expectations through changes in security holdings.

-Active: Investor seeks to outperform a benchmark portfolio by identifying stocks that will perform well and avoiding stocks that will underperform

-Semi-active: Investor seeks to outperform the benchmark but is mindful of tracking risk relative to the benchmark

- (b) Calculate the weighting of XYZ under each of the following index weighting methods:

i) Price-weighted

ii) Equal-weighted

iii) Float-weighted

Commentary on Question:

The candidates performed very well on this section. Successful candidates needed to show their work using the formulas for each method in order to receive full credit.

(i) Price-Weighted:

Sum of all prices: $84 + 42 + 35 = 161$

Price-weighted weight of XYZ = $35 / 161 = 22\%$;

(ii) Equal-Weighted:

3 stocks equally weighted, so $1/3 = 33\%$ each.

Equal-weighted weight of XYZ = 33%

(iii) Float-Weighted:

Sum of all free-float = $[25,000 + (40,000 \times 0.5) + (36,000 \times 0.75)] = 72,000$

Float-weighted weight of XYZ = $(36,000 \times 0.75) / 72,000 = 27,000 / 72,000 = 38\%$

- (c) Explain why the existing manager may have underperformed the index.

Commentary on Question:

The candidates performed below average on this section. They mostly correctly commented on transaction costs, but management expenses and taxes were often omitted. Candidates needed to state and explain how those four items could result in the investment underperforming the index, in order to receive full credit.

- Expenses: the fund manager has expenses to manage and administer the fund, while the index does not have expenses.

- Transaction Costs: the fund manager pays transaction costs to buy/sell securities which they need to do when there are inflows/outflows to the fund. The index does not have transaction costs.

- Illiquidity of Small Cap: small cap stocks are less liquid with higher bid-ask spreads, and full replication means taking many small positions. The index does not reflect bid-ask spreads or illiquidity of index components.

- Taxes: the fund must pay taxes on dividends and realized capital gains which the index does not reflect.

- (d) Describe how equitized long-short portfolios are typically structured.

Commentary on Question:

The candidates performed as expected on this question. Candidates needed to specify that base long-short beta is likely near 0 and also specify the instruments that are used to obtain equity exposure (futures or ETFs), in order to receive full credit.

- Long position in stocks expected to outperform
- Short position in stocks expected to underperform
- Beta from long-short position is likely close to zero
- Futures or ETFs are used to obtain equity exposure and add pure beta to portfolio

- (e) Explain why the long-short strategy may be more appropriate than the long-only strategy.

Commentary on Question:

The candidates performed below average on this question. Candidates needed to reference the specific situation in the answer in order to receive full credit – general comments about long-only or long-short investing received partial credit. Candidates were also expected to discuss the presence of leverage in this type of strategy..

- Long-short strategies have an inherent efficiency advantage, which is ability to act on negative insights that the investor may have, and which can never be fully exploited in a long-only context.
- In order to magnify the difference in alphas between two stocks, long-short managers sometimes leverage their capital as much as 2-3 times using borrowed money. Although leverage magnifies the opportunity to earn alpha, long-short portfolio is subject to borrowing constraints and other risks.
- With the given long-short approach, not only can the investment manager take equivalent long or short positions in all 50 stocks in the index, the manager may also be able to use stocks not included in the index in order to increase the opportunity set.

6. QFI PM Spring 2021, Question 2

Learning Outcome(s): 2f, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 10, Ch 19

This question tested the candidate's knowledge of fixed income portfolio strategies. Overall, candidates performed as expected.

Solution:

(a)

- (i) Describe one advantage and one disadvantage of the full replication approach investment strategy.
- (ii) Describe an alternative fixed income investment strategy for the Long Corp Portfolio which could improve performance.

Commentary on Question:

Candidates performed brilliantly on this section. For part (i) many candidates identified low tracking risk and high transaction costs as the advantage and disadvantage of the strategy, respectively. One common mistake in part (i) is that candidates suggested that a fully-replicated portfolio is easy to implement – this may not be the case as certain investments within a benchmark may be illiquid.

For part (ii) many successful candidates described enhanced indexing or stratified sampling strategies to help improve fund performance. Candidates who suggested using active or semi-active strategies were not awarded points as the purpose of this fund is to closely track an index.

- (i) Advantages to a full replication strategy include:
 - Minimizing tracking risk relative to the benchmark
 - Lower management fees
 - Outperforming a broadly based market index on a consistent basis is difficult.

Disadvantages to a full replication strategy include:

- Full replication is difficult to set up and expensive to implement.
- Many issues in a typical bond index are quite illiquid and very infrequently traded.

(ii) Enhanced indexing would be a viable alternative to full replication for this portfolio. Enhanced indexing involves selecting a sample of assets within the benchmark such that the duration, sector, credit quality, etc. are not materially different from the benchmark. It reduces construction and maintenance cost of the portfolio, and enables managers to enhance portfolio's return by using bonds that are perceived undervalued.

(b) Calculate the average active return and tracking risk for each of the portfolios.

Commentary on Question:

Candidates performed above average on this section. Candidates who performed well on this question included the formulas for active returns and tracking risk, and successfully computed their values. Two common mistakes that candidates made was that they used the incorrect denominator of the tracking risk calculation, or they calculated the variance of portfolio instead of the tracking risk.

Active return = AR_i = portfolio's return – benchmark index's return

$$\text{Average active return} = \text{Avg AR} = \frac{\sum_1^n (r_i - b_i)}{n}$$

$$\text{Tracking Risk} = \text{standard deviation of the active returns} = \sqrt{\frac{\sum_1^n (AR_i - \text{Avg AR})^2}{n-1}}$$

For the High Yield ETF, average active return = -0.13%

For the High Yield ETF, tracking risk = 0.48%

For the Growth ETF, average active return = 1.00%

For the Growth ETF, tracking risk = 4.83%

- (c) Your colleague is looking at ways to improve Investment Grade Corp Portfolio performance. Based on current market trends, they believe that interest rates are set to decline significantly at longer durations. As a result, your colleague wants to use leverage so that they can increase the fund's exposure to long duration assets. Your colleague plans on buying interest rate futures to capitalize on their forecasts.

Critique your colleague's strategy.

Commentary on Question:

Candidates performed below average on this section. Successful candidates were able to conclude that, based on your colleague's analysis, the proposed strategy would work. Successful candidates also noted that interest rate futures contain leverage, and as such this would be a risky approach. Many candidates wrote that a decline in interest rates would result in a decline in value of an interest rate future – this is not correct.

Note that the candidate did not need to include all remarks listed below in order to achieve full marks.

The purpose of leverage is to potentially magnify return. Leverage cuts both ways however. If markets do not play out as expected then the fund will underperform even more. While the statement about leverage is true at face value, there is a significant risk associated with using a large amount of leverage in a portfolio.

Interest rate futures are frequently used portfolio strategy to target a specific duration target. When interest rates decline, futures prices will increase; this

means buying interest rate futures is appropriate. The statement is therefore true, your colleague is correct in their assessment.

- (d) Your pension client sends you projected liability cash flows from which you are expected to develop and implement asset strategies for a defined benefit plan. The client is very sensitive to interest rate risk and wishes to control their investment expenses. The plan is frozen and very mature with the majority of members having already retired. It is well funded.

Recommend an investment strategy to employ for this client.

Commentary on Question:

Candidates performed below average on this section. Successful candidates identified cash flow matching or cash flow matching for the initial period with duration matching thereafter as appropriate strategies to meet the pension plan's objectives. Candidates who wrote duration-matching or immunization did not receive full marks as these strategies only protect the plan against parallel shifts in the interest rate curve. Several candidates suggested specific asset classes to invest in – this was not accepted as an answer as the question specifically asked for an investment strategy. In order to receive full marks, a candidate must explain how their proposed strategy addressed both of the pension funds concerns.

I would recommend a cash flow matching strategy for this client. Cash flow matching minimizes interest rate risk exposure as assets and liabilities will move in the same direction based on changes in the interest rate. Cash flow matching also requires the least amount of rebalancing, so there will be lower transaction costs.

7. QFI PM Fall 2020, Question 10

Learning Outcome(s): 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

This question tests the concept of performance measurement and attribution.

Solution:

- (a) Explain how you would approximate a time-weighted rate of return for the entire year of 2019.

Commentary on Question:

The candidates performed brilliantly on this section. Most candidates successfully identified the LIRR approach and chain-link method. A few candidates did not receive credit for providing answers to why you would approximate a time-weighted rate of return.

Use a linked internal rate of return (LIRR) approach to approximate a time-weighted rate of return for the entire year of 2019. This approach takes the money-weighted rate of return values and then chain-links the returns over the entire evaluation period.

- (b) Discuss the limitation of approximating a time-weighted rate of return calculation this way.

Commentary on Question:

The candidates performed as expected on this section. Those candidates that specified that large cashflows and volatile swings would affect time-weighted return received full credit. Some candidates received partial credit for simply saying that the cashflows have an impact on time-weighted rate of return.

Only under unusual circumstances would the LIRR fail to provide an acceptable representation of the time-weighted return. Specifically, the LIRR would fail if both large external cash flows (generally over 10 percent of the account's value) and volatile swings in subperiod performance occurred during the evaluation period.

- (c) Determine the approximate time-weighted rate of return.

Commentary on Question:

The candidates performed above average on this section. Most candidates successfully calculated the time-weighted rate of return.

$$rLIRR = (1 + 5.3\%) * (1 - 3.2\%) * (1 + 4.5\%) * (1 + 1.2\%) - 1 = 7.8\%.$$

- (d) Determine how the investment manager performed on the Technology sector based on performance attribution analysis.

Commentary on Question:

The candidates performed above average on this section. Most candidates successfully calculated two or three performance impact factors. Partial credit was given to those candidates that just calculated the factors without providing proper comments and analysis.

The performance impact of the technology sector allocation:

$$(12.41\% - 16.20\%) * (-0.25\% - 0.66\%) = 0.03\%$$

The decision to underweight a sector that performed worse than the overall benchmark resulted in a positive contribution to the performance of the portfolio relative to the overall benchmark.

The performance impact of security selection within the technology sector:

$$16.20\% * (2.05\% - (-0.25\%)) = 0.37\%$$

The portfolio held technology stocks that in total performed better than the aggregate performance of the technology stocks contained in the sector benchmark, indicating the security analysts outperformed the benchmark by

identifying significantly mis-valued securities and recommending appropriate action.

The allocation / selection interaction return for technology:

$$(12.41\% - 16.20\%) * (2.05\% - (-0.25\%)) = -0.09\%$$

(e)

- (i) Calculate the specific or unexplained return component.
- (ii) Interpret the attribution.

Commentary on Question:

The candidates performed poorly on this section. Some candidates correctly calculated specific and unexplained components, but only a few candidates properly interpreted the attribution. Candidates that simply stated that the fund underperformed due to negative factors received partial credit.

- (i) The portfolio manager's investment skill or value added = $6.05\% - 5.85\% = 0.20\%$
The return due to specific (unexplained) = $0.20\% - (5.76\% - 5.85\%) - (5.24\% - 5.85\%) - (6\% - 5.85\%) = 0.75\%$
- (ii) The unexplained return is so large, which suggests it might miss fundamental risk factor or economic sector in the attribution. Or it could indicate the benchmark or normal portfolio is not based solely on the exposures to investment risk factors. In this case, the benchmark portfolio will have a specific or unexplained return component. The difference between it and the portfolio's specific return should be attributed to the investment manager.

8. QFI PM Fall 2020, Question 16

Learning Outcome(s): 2d, 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6, Ch 10

This question tests the concepts and applications of asset liability management for long tail insurance liabilities.

Solution:

(a)

- (i) Identify the common strategies under the two dimensions of ALM practice.
- (ii) Determine which ALM strategies are the more appropriate for ABC Life.

Commentary on Question:

The candidates performed average on this section. Most students gave adequate answers for one dimension: cashflow matching versus duration matching (or immunization), but many missed the second dimension of static versus dynamic.

(i)

- 1. Cashflow matching vs duration matching (or immunization)
- 2. Static approach vs dynamic approach

(ii)

- 1. Duration matching. Given that ABC Life has long term liabilities and is exposed to significant interest rate risk, the duration matching strategy is more appropriate for ABC Life.
- 2. Dynamic approach. The risks embedded in the ABC Life's liability products are too complex and significant in volume, dynamic rebalancing strategy is more appropriate for ABC Life.

- (b) Calculate the minimum gross return requirement under ABC Life's IPS.

Commentary on Question:

The candidates performed well on this section. A few candidates failed to properly incorporate inflation or solved for the required return additively.

$$\begin{aligned}\text{GrossRet} &= (1 + \text{NetRet}) * (1 + \text{Inflation}) * (1 + \text{Cost of Investment}) - 1 \\ &= (1+5\%) * (1+2\%) * (1+1\%) - 1 \\ &= 8.17\%\end{aligned}$$

- (c) With the above data, your analyst used the Mean-Variance Approach to calculate five corner portfolios (as shown in Table 2 below) to construct the efficient frontier for portfolio optimization. No short-selling is allowed. The current risk-free rate is 3%.

Table 2	Corner Portfolio	Mean Return	Standard Deviation	Sharpe Ratio	Portfolio Weight (Asset Class)			
					Equity	Bond	Mortgage	Real Estate
	1	15%	32%		100%	0%	0%	0%
	2	13%	A	B	60%	0	40%	0
	3	11%	13%	61.5%	20%	2%	72%	6%
	4	C	7%	85.7%	11%	36%	40%	13%
	5	7%	3.6%	111.1%	2%	70%	8%	20%

Calculate A, B, and C in Table 2.

Commentary on Question:

The candidates performed well on this section. Those that did not do well failed to incorporate correlations and portfolio weightings to calculate A.

$$A = \text{StDev}(\text{CornerPort2})$$

$$\begin{aligned}&= \text{sqrt}[(\text{EquityWeight} * \text{EquityVariance})^2 + (\text{MortgageWeight} * \text{MortgageVariance})^2 + \\ &2 * \text{EquityWeight} * \text{MortgageWeight} * \text{EquityVolatility} * \text{MortgageVolatility} * \\ &\text{Correlation}(\text{Mortgage}, \text{Equity}))\end{aligned}$$

$$= \text{sqrt}(60\%^2 * 32\%^2) + (40\%^2 * 12\%^2) + 2 * 60\% * 40\% * 32\% * 12\% * 0.45$$

$$= 21.79\%$$

$$B = \text{SharpeRatio}(\text{CornerPort2})$$

$$= [\text{Ret}(\text{CornerPort2}) - \text{RiskFree}] / \text{StDev}(\text{CornerPort2})$$

$$= (13\% - 3\%) / 21.79\%$$

$$= 45.90\%$$

$$C = \text{Ret}(\text{CornerPort24})$$

$$= 11\% * \text{EQRet} + 36\% * \text{BondRet} + 40\% * \text{MortgageRet} + 13\% * \text{RealEstateRet}$$

$$= .11*.15+.36*0.05+.40*.10+.13*.12$$

$$= 9.01\%$$

- (d) Calculate using the Corner Portfolio Theorem the respective weight for equity and for bond in the efficient portfolio that will meet ABC Life's investment objective.

Commentary on Question:

The candidates performed well on this section. Those that did not do well did not solve for weights by interpolating between corner portfolios 4 and 5.

$$\text{TargetRet} = w * \text{Ret}(\text{CornerPort4}) + (1-w) * \text{Ret}(\text{CornerPort5})$$

$$w = (\text{TargetRet} - \text{Ret}(\text{CornerPort5})) / (\text{Ret}(\text{CornerPort4}) - \text{Ret}(\text{CornerPort5}))$$

$$w = (8.17\% - 7\%) / (9\% - 7\%)$$

$$w = 58.5\%$$

$$\text{Target Equity Weight} = \text{CornerPort4w1} * w + \text{CornerPort5w1} * (1-w)$$

$$= 11\% * 58.5\% + 2\% * (1 - 58.5\%)$$

$$= 7.27\%$$

$$\text{Target Bond Weight} = \text{CornerPort4w2} * w + \text{CornerPort5w2} * (1-w)$$

$$= 36\% * 58.5\% + 70\% * (1 - 58.5\%)$$

(e) ABC Life is considering two alternative approaches for portfolio optimization:

- (i) Black-Litterman Approach
- (ii) Experience-Based Approach

Critique the above alternative approaches for portfolio optimization.

Commentary on Question:

The candidates performed average on this section. Most candidates provided a few characteristics of each approach. Most candidates failed to mention that the Black-Litterman approach is more stable and diversified than Mean Variance Optimization, and reduces estimation errors.

Black-Litterman Approach

This approach reverse-engineers the expected returns implicit in the diversified market portfolio (or reverse optimization) and combines them with the investor's own views on expected returns

in a systematic way that takes into account the investor's confidence in his or her views.

Black-Litterman Approach is more stable and diversified than Mean Variance Optimization, incorporates investor's view, and reduces estimation errors.

Experience-Based Approach

Most common experience-based approaches use tradition, experience and rules of thumb in making strategic asset allocation recommendations:

- 60/40 stock/bond asset allocation is appropriate or at least a starting point for an average investor's asset allocation.
- Allocation to bonds should increase with increasing risk aversion.

- Investors with longer time horizons should increase their allocation to stocks.
- A rule-of-thumb for the percentage allocation to equities is 100 minus the age of the investor
- This approach is more appropriate for investment managers serving individual clients.

9. QFI PM Fall 2021, Question 1

Learning Outcome(s): 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

This question tests the candidate's understanding of performance evaluation, as well as the fundamentals underlying benchmarks.

Solution:

- (a) List four criteria for establishing a good benchmark.

Commentary on Question:

Candidates performed brilliantly on this section. Most candidates were able to successfully recall four criteria for establishing a good benchmark. Several candidates confused the criteria for a good benchmark with the tests used to assess the quality of the benchmark in part (b).

The following items would be considered acceptable criteria for a good benchmark:

- Unambiguous
- Investable
- Measurable
- Appropriate
- Reflective of Current Investment Opinions
- Specified in Advance
- [Accountable](#) (Owned)

Note that candidates were only required to list four of the above items to get full marks.

- (b) Describe three heuristic tests that can be performed to assess the quality of a benchmark.

Commentary on Question:

Candidates performed as expected on this section. Successful candidates were able to list and describe three separate tests – in many cases candidates only listed the tests without providing an adequate description. Several candidates confused the criteria for a good benchmark in part (a) with the tests used to assess the quality of the benchmark.

The following tests may be used to evaluate the quality of a benchmark:

- Systematic biases: There should be minimal systematic biases between the portfolio returns and the benchmark. One test for this would be to calculate the Beta between the portfolio and benchmark – the Beta should be close to 1 if there is no systematic bias.
- Tracking error: The tracking error between a portfolio and a benchmark should be less than the tracking error between the portfolio and a market index/alternative benchmark.
- Risk characteristics: A portfolio's exposure to systematic risk sources of risk should be consistent with the benchmark
- Coverage: There should be a high degree of overlap between the investments included in a portfolio relative to the assets included within a benchmark.
- Turnover: The turnover of assets within a benchmark should not be excessively high – benchmarks with high turnover may preclude the successful implementation of a passively managed portfolio
- Positive active positions: For long-only portfolios, there should not be a large proportion of negative active positions.

Note that candidates were only required to describe three of the above items to get full marks.

- (c) Assess the appropriateness of calculating returns using each of the methods listed below:

- i) Time-weighted rate of return
- ii) Dollar-weighted rate of return

Commentary on Question:

Candidates performed as expected on this question. In order to receive full marks, candidates were expected to describe both the time-weighted and dollar-weighted rate of return and then to justify why the time-weighted rate of return was appropriate. One common pitfall was candidates only providing a description of the returns without making a recommendation on which metric is appropriate, or only providing a recommendation on which metric is appropriate without justifying it.

- Money-weighted returns calculate investment performance using all cash flows included in the portfolio
- Time-weighted returns calculate investment performance based on a single unit of account
- Using a time-weighted return would be appropriate for this scenario due to the fact that there are external cash flows that the investment manager does not control.

- (d) ~~A colleague is analyzing the following quality control chart for Portfolio Y, which is calibrated at the 80th percentile.~~

~~Your colleague claims that, based upon the above chart, the portfolio manager is truly skillful as they were able to outperform the benchmark by 1.6% per year over a 20 year period.~~

~~Critique your colleague's statement.~~

Commentary on Question:

~~Candidates performed as expected on this question. Many candidates were able to successfully identify that their colleague's statement is incorrect. One common omission from candidates' solutions was stating the null hypothesis of the quality control chart.~~

- ~~Your colleagues cannot make this conclusion based on the quality control chart~~
- ~~Null hypothesis of a quality control chart is that a portfolio manager has no skill~~
- ~~Confidence bands represent the range of value-added returns we would expect the portfolio manager to provide during the specified time horizon, assuming the null hypothesis is correct.~~
- ~~In this case, the portfolio manager's returns do not exceed the confidence bands within the quality control chart, so we fail to reject the null hypothesis that the portfolio manager has no skill~~

10. QFI PM Fall 2021, Question 2

Learning Outcome(s): 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 10

This question tests the understanding of constructing a bond portfolio along with its associated risks. Candidates are reminded to always show their working, especially when asked to calculate, in order to receive partial credit. Overall, candidates performed below average on this question.

Solution:

- (a) Calculate the US dollar duration of the portfolio.

Commentary on Question:

Candidates performed as expected on this question. Some candidates did not use the correct direction for the currency conversion to USD, and many candidates did not consider the foreign country betas. Another common mistake was not dividing duration by 100, which showed a fundamental misunderstanding of the dollar duration measure.

$$MV^A = 3MM \times 110.45\% \times 1 = \$3,314,155.68$$

$$MV^B = 3MM \times 102.18\% \times 1.2161 = \$3,727,734.58$$

$$MV^C = 4MM \times 104.00\% \times 0.8251 = \$3,432,423.96$$

$$Dur^A = MV^A \times \frac{4.71}{100} \times 1.00 = 156,114.76$$

$$Dur^B = MV^B \times \frac{3.99}{100} \times 0.42 = 62,547.06$$

$$Dur^C = MV^C \times \frac{2.92}{100} \times 0.47 = 47,147.18$$

$$\text{\$ duration} = 265,809.00$$

- (b) Calculate the rebalancing ratio for the portfolio given the stated goals.

Commentary on Question:

*Candidates performed below average on this question. Two common mistakes were estimating the bond prices at year 1 (instead of calculating the future bond prices from first principles using the projections), and subtracting 1 from the rebalancing **ratio**. Successful candidates used the provided information to calculate the new bond prices at year 1 before following similar steps to part (a) to derive the new dollar duration and the consequent rebalancing ratio.*

$$\begin{aligned} Price^A &= 3\% \times (1 + 1.00\%)^{-1} \times \frac{1 - (1 + 1.00\%)^{-4}}{1 - (1 + 1.00\%)^{-1}} + 1 \times (1 + 1.00\%)^{-4} \\ &= 107.80\% \end{aligned}$$

$$\begin{aligned} Price^B &= 0.2\% \times (1 \pm .27\%)^{-1} \times \frac{1 - (1 \pm .27\%)^{-3}}{1 - (1 \pm .27\%)^{-1}} + 1 \times (1 \pm .27\%)^{-1 \times 3} \\ &= 101.42\% \end{aligned}$$

$$\begin{aligned} Price^C &= 2.25\% \times (1 + 0.97\%)^{-1} \times \frac{1 - (1 + 0.97\%)^{-2}}{1 - (1 + 0.97\%)^{-1}} + 1 \times (1 + 0.97\%)^{-2} \\ &= 102.52\% \end{aligned}$$

$$MV^A = 3MM \times 107.80\% \times 1 = \$3,234,117.97$$

$$MV^B = 3MM \times 101.42\% \times 1.10 = \$3,346,764.09$$

$$MV^C = 4MM \times 102.52\% \times 0.7692 = \$3,154,415.48$$

$$Dur^A = MV^A \times \frac{3.82}{100} \times 1.00 = 123,435.92$$

$$Dur^B = MV^B \times \frac{3.00}{100} \times 0.42 = 42,142.66$$

$$Dur^C = MV^C \times \frac{1.97}{100} \times 0.47 = 29,187.69$$

$$\text{\$ duration} = 194,767.86$$

$$\text{Rebalancing Ratio} = 265,809 / 194,767.86 = 1.365$$

- (c) Critique the portfolio manager's plan on hedging all currency exposures assuming Interest Rate Parity holds.

Commentary on Question:

Candidates performed poorly on this question. Many candidates provided the definition of Interest Rate Parity (IRP) without tailoring their answer to the context of the question, which is currency hedging. Successful candidates recognized that since currency is hedged and the sovereign bonds were assumed to have no credit risk, the returns should be equal under IRP. Partial credit was given to reasonable answers showing that hedged returns are higher than unhedged returns.

Since the yield curves are flat and Interest Rate Parity holds, we can approximate the hedged return (HR) as

$$HR \approx i_{\$} + (r_t - i_{\text{F}})$$

where $r_t - i_{\text{F}}$ is the bond's local risk premium.

~~There is no local risk premium since all bonds are sovereign risk-free bonds and given the flat yield curve, the hedged return will be the same for all of them and equal to the USD bond return, which is 0.85%.~~

11. QFI PM Fall 2021, Question 8

Learning Outcome(s): 2h, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 13, Ch 19

This question tests candidates' understanding of equity selection strategies, investment styles of asset managers, and issues related to ESG.

Solution:

- (a) Assess if the current portfolio of managers is expected to meet the investment objectives.

Commentary on Question:

The candidates performed above average on this section. Many candidates received full credit on this section. Some candidates assessed each portfolio manager separately against the stated investment objectives rather than the aggregation of all 3 portfolio managers and thus received partial credit.

The portfolio's expected alpha is $(5/10)(2\%) + (3/10)(2\%) + (2/10)(4\%) = 2.4\%$

The portfolio's tracking risk is $[(5/10)^2(2\%)^2 + (3/10)^2(3\%)^2 + (2/10)^2(5\%)^2]^{1/2} = 1.68\%$

The portfolio's information ratio = $2.4/1.68 = 1.43$ which is higher than the required ratio of 1, and the portfolio's tracking risk is lower than 2%. Both investment objectives are met.

- (b) Assess if the current portfolio of managers is expected to meet the investment objectives, based on the revised benchmark and managers' true active return and active risks.

Commentary on Question:

The candidates performed below average on this section. Most candidates correctly calculated the managers' true active returns and the portfolio's expected alpha. Most candidates didn't correctly calculate the managers' true active risks and thus also came up with an incorrect portfolio tracking risk.

Manager's return – Manager's normal benchmark = Manager's true active return.

As the revised benchmark's return is 1% higher than the outdated benchmark, the true active return for Manager A, B, C are 1%, 1%, and 3%, respectively.

Manager's total active risk = $[(\text{Manager's true active risk})^2 + (\text{Manager's misfit active risk})^2]^{1/2}$

Manager's misfit active risk = 1% for all three managers

Managers' total active risks are 2%, 3%, and 5% from the table

Managers' true active risks are 1.73%, 2.83%, and 4.90%, respectively

The portfolio's expected alpha is $(5/10)(1\%) + (3/10)(1\%) + (2/10)(3\%) = 1.4\%$

The portfolio's tracking risk is $[(5/10)^2(1.73\%)^2 + (3/10)^2(2.83\%)^2 + (2/10)^2(4.90\%)^2]^{1/2} = 1.56\%$

The portfolio's information ratio = $1.4/1.56 = 0.90$. The portfolio's tracking risk is 1.56%. The information ratio objective is no longer met, but the tracking risk objective is still met.

- (c) Compare and contrast these two types of techniques for identifying investment styles.

Commentary on Question:

The candidates performed above average on this section. Most candidates accurately compared and contrasted several aspects of these techniques. Partial credit was awarded for each valid statement about these techniques.

- Returns-based style analysis:
 - Focuses on characteristics of the overall portfolio as revealed by a portfolio's realized returns
 - Involves regression portfolio returns (generally monthly returns) on return series of a set of securities indices
 - Can be used to calculate the portfolio's beta with respect to various styles
 - The coefficient of determination can measure the style fit
 - Pro: Aggregates the effect of the investment process
 - Pro: Different models usually give similar results
 - Con: May be ineffective in characterizing current style
 - Con: Error in specifying indices in model may invalidate result
- Holding-based style analysis:
 - Categorizes individual securities by their characteristics
 - Aggregates results to reach a conclusion about the overall style of the portfolio at a given point in time
 - Pro: Characterizes each position and facilitates comparisons of individual positions
 - Pro: May capture style changes more quickly
 - Con: Not consistent with how portfolio managers select securities
 - Con: Different specifications will lead to different results
 - Con: More data intensive

(d) Analyze Manager B's investment style.

Commentary on Question:

The candidates performed as expected on this section. Many candidates concluded that manager B's investment style was growth because of the P/E, P/B, and dividend yield metric; however, given these metrics are quite similar to the benchmark, manager B's investment style is more appropriately considered market-oriented with a slight tilt towards growth. Candidates that concluded the investment style was growth received partial credit.

The holdings-based analysis suggests a market-oriented portfolio with a slight tilt to growth.

The portfolio's P/E, P/B, are slightly higher than those of the benchmark, and the dividend yield is slightly lower than the benchmark. All three metrics suggests a slight tilt toward growth.

- (e) Describe four benefits of incorporating ESG criteria in portfolio management.

Commentary on Question:

The candidates performed above average on this section. Many candidates received full credit on this section. Nearly all candidates provided at least two benefits of incorporating ESG criteria in portfolio management. Partial credit was awarded for each appropriate benefit provided.

- A lack of an ESG framework can have a negative impact to these firm's image and hurt profits
- Establishing ESG criteria can be useful to identify firms that are inattentive to ESG issues
- Environmental crises can cause sudden changes in regulations, technology, and consumer tastes, which can cause large swings in asset prices
- With ESG criteria in place, portfolio managers can select firms that are well prepared to deal with these sudden changes
- ESG-related risks can be rare, large, and non-diversifiable
- ESG criteria will help investors assess exposure to risks better than a purely statistical model that relies on historical data

12. QFI PM Fall 2021, Question 12

Learning Outcome(s): 2d

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6

This question tested candidate understanding of Mean Variance Theory and its application in the Efficient Frontier. Candidates were also tested on how to calculate risk in a portfolio and how to construct portfolios on the Capital Allocation Line.

Solution:

(c) Define the following:

- (i) Efficient Portfolio
- (ii) Global Minimum Variance Portfolio
- (iii) Tangency Portfolio
- ~~(iv) Capital Allocation Line~~

Commentary on Question:

The candidates performed above average on this section. Many candidates accurately defined Efficient Portfolio and Global Minimum Variance Portfolio. A common mistake was mixing up the definitions of Tangency Portfolio and Capital Allocation Line.

- (i) An efficient portfolio is one that makes efficient use of risk; that is, for any given level of risk (standard deviation), the portfolio that maximizes the return (mean)
- (ii) Out of all the available efficient portfolios, it is the portfolio that minimizes risk (standard deviation)
- (iii) A Tangency Portfolio is an efficient portfolio with the highest Sharpe Ratio
- ~~(iv) The Capital Allocation Line connects the Risk-Free rate on y-axis to the Tangency Portfolio. It represents combinations of Standard Deviations and Returns available to an investor when they combine their optimal portfolio with a Risk-Free asset.~~

(b) Calculate the standard deviation of the client's current portfolio. (Solve for X)

Commentary on Question:

The candidates performed brilliantly on this section. Most candidates earned full credit for their answers. Candidates received partial credit for providing the correct formulas, even though the standard deviation was not calculated correctly.

$$\sigma_P^2 = w_{Bond}^2 \sigma_{Bond}^2 + w_{Equity}^2 \sigma_{Equity}^2 + 2w_{Bond}w_{Equity}\sigma_{Bond}\sigma_{Equity}\rho$$

Where $w_{Bond} = 0.928$; $w_{Equity} = 0.072$; $\sigma_{Bond} = 0.05$; $\sigma_{Equity} = 0.12$; $\rho = 0.25$ (all provided as part of the question)

$$\sigma_P^2 = (0.928 \times 0.05)^2 + (0.072 \times 0.12)^2 + 2 \times (0.072 \times 0.12) \times (0.928 \times 0.05) \times 0.25$$

$$\sigma_P^2 = 0.00215296 + 0.00007465 + 0.000200448$$

$$\sigma_P^2 = 0.00242806$$

$$\sigma_P = 4.928\%$$

(c)

(i) Explain why your manager is incorrect.

Assess possible impacts to your client's portfolio if your manager's recommendation is followed. (Hint: be sure to compare to your client's IPS notes and comment on the change in standard deviation and expected return.)

Commentary on Question:

The candidates performed as expected on this section. Candidates who performed well recognized that the portfolio was already on the minimum variance frontier, so no portfolio using the available assets could reduce the variance. A common mistake was to state that risk could be further reduced by introducing risk-free assets, even though the question was focused on changing bond and equity allocations in the current portfolio.

- (i) As the portfolio is a Minimum Variance Portfolio, which is an efficient portfolio, which is part of the minimum variance frontier; any portfolio on this frontier, has the lowest level of risk for the given level of return. By definition, using the assets available, there is no portfolio that can reduce the variance. Any change to the portfolio will only increase the risk.
- (ii) As bonds and equities already provide sufficient diversification, the risk is already minimized, while maximizing returns. As the MVP portfolio already represents the lowest risk, adding more bonds will

only increase the standard deviation, while reducing the overall return. This is opposite of what the client wants.

(d)

- (i) Describe how to use the capital allocation line to create a portfolio for your client with less risk (smaller standard deviation) but same expected return as his current portfolio (MVP).
- (ii) Calculate the asset mix and standard deviation of the portfolio that has the same expected return as the client's current portfolio but smaller standard deviation.

Commentary on Question:

The candidates performed as expected on this section. Candidates who accurately defined the Capital Allocation Line in (a) generally performed well on (i). Candidates who calculated an incorrect value of X in (ii) received partial credit for providing the correct formulas and coming up with a standard deviation lower than the MVP portfolio.

- (i) The capital allocation line represents the combination between the tangency portfolio and the risk-free asset. Using this line, proportions can be set between the Tangency Portfolio, to increase the return, and the risk-free asset, to reduce the risk, can be determined. The overall proportions would result in a portfolio that has the same expected returns as the current portfolio, with a lower level of risk.

Using the formula $r_P = X \cdot r_{TangencyPortfolio} + (1 - X) \cdot r_f$, where X is the proportion of the Tangency Portfolio, and the remaining amount is the Risk-Free asset, solve for X.

$$r_{TangencyPortfolio} = 4.92\%; r_f = 1\%; r_P = 4.29\%$$

$$X = 83.5\%$$

To calculate the Standard Deviation σ_P :

$$\begin{aligned} \sigma_P^2 = & X^2_{TangencyPortfolio} \sigma^2_{TangencyPortfolio} + (1 - X)^2_{Risk Free Asset} \sigma^2_{Risk Free Asset} \\ & + 2X_{TangencyPortfolio} (1 \\ & - X)_{Risk Free Asset} \sigma_{TangencyPortfolio} \sigma_{Risk Free Asset} \rho \end{aligned}$$

However, as $\sigma_{Risk Free Asset} = 0$, $\sigma_P^2 = X_{TangencyPortfolio}^2 \sigma_{TangencyPortfolio}^2$

$$\sigma_P = (83.5\% * 5.29\%) = 4.42\%$$

This is less than the Standard Deviation of 4.93% calculated in (b).

13. QFI PM Fall 2021, Question 13

Learning Outcome(s): 2b, 2d

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6

This question tests understanding of considerations and constraints to consider in an IPS with a new pension plan for a P&C insurer.

Solution:

- (a) Describe four reasons why an Investment policy statement (IPS) is important to ABC's pension plan.

Commentary on Question:

Candidates performed above average in this section. Candidates were successful at identifying the importance of IPS for setting the return objectives, the management of risks and constraints. Most candidates did not identify the IPS as a formal document but described general components in the IPS.

An IPS provides:

- A governing document for all investment decisions and portfolio management process.
- Return objectives and risk tolerance over the relevant period of time.
- Potential constraints such as liquidity, tax, regulation.

- Guidance for other issues such as reporting, performance measurement and investment strategy.

(b) Describe how each of the following relates to ABC's IPS:

- (i) Capital market expectation (CME)
- (ii) Strategic asset allocation (SAA)

Commentary on Question:

Candidates performed below average in this section. For the CME candidates failed to mention the optimization of expected return versus the level of risk in the portfolio.

Candidates specified for SAA the determination of asset class but rarely mentioned the long-term objective of the risk and expected return of the portfolio.

- (i) CME form the basis to establish a portfolio of investment and maximize the expected return for a given level of risk or minimize risk for an expected return.
- (ii) SAS establishes acceptable exposures to IPS and describes permissible asset classes to achieve long-term objectives as to return on investment and constraints of the portfolio.

(c) The board suggests to use ABC's IPS for insurance products with minor modifications.

Critique this suggestion.

Commentary on Question:

Candidates performed as expected on this section. Almost all candidates mentioned risks are different especially for the return, liquidity, and time horizon. A few candidates specified the need to reflect the differences associated with the liabilities. Most candidates missed addressing the distinction between a DB plan or DC plan and the insurer as to the owner of investment risk.

Major modifications are required and we need a distinct IPS for the pension plan.

The risks and returns of the pension plan are interdependent and different from the insurer.

Also, constraints are different for liquidity need, time horizon of investment and liabilities, tax, and regulation.

Specific aspects of which party bears the risk in a pension plan as to the plan sponsor (ABC) in a DB plan or the participants in a DC plan which are not present for the insurer business.

- (d) Explain how an IPS is used for investment risk management of a DC plan.

Commentary on Question:

Candidates performed below average in this section. Many candidates did not mention the IPS as a document to guide the selection of investment options or is periodically offered to plan participants to evaluate those options.

Few candidates mentioned the risk associated with the investment by participants in the company stock program and the objective of the IPS to promote diversification with multiples options for investments.

The IPS of a DC plan documents the process for selecting the investment options offered to plan participants with a periodical valuation of such options.

The IPS establish procedures to ensure that a multitude of individual investor objectives and constraints by addressed.

The IPS promotes diversification of investments in the portfolio by participants with a specific concern to limit investments in the sponsor company stock.

(e) Explain the relevant considerations for ABC to incorporate in the IPS for a DB and DC plan, respectively, for each of the following:

- Risk and return objectives;
- Liquidity;
- Time horizon;
- Investment options.

Commentary on Question:

Candidates performed below average in this section. Many candidates did not address distinct issues for both the DB and DC plans, and instead focused on the DB plan only. Some candidates described generic considerations and did not tailor their answer to ABC's situation, as requested in the question.

Almost all candidates who provide an explanation for a DB plan were able to identify relevant considerations for each aspect except for investment options. Two key areas missed by most candidates, for investment options, are the complexities of investing in alternative assets and the conflict of interest in plan sponsors investing in their own company stock.

For a DC plan, few candidates successfully explained that the plan participant, not insurance company, is responsible for their risk and return and the need for these participants to receive investment advice. Almost all candidates were not able to explain that they need to value liquidity and time horizon of investments according to their own choices. Similar to a DB plan, candidates missed the risk associated with investment into company stock of plan sponsor as an investment option.

a) For a DB plan

Risk and return:

With young workforce and all active participants then greater duration of liability and greater risk tolerance for plan sponsor.

Objective to obtain higher investment return with alternative assets justified by greater risk tolerance.

Liquidity:

The young workforce indicates long duration and little need for immediate liquidity.

Then may invest into long-term less liquid assets with potential of higher return to improve the funding status of a pension plan.

Time horizon:

Without employees close to retirement and little departure may focus on long-term duration and justify aggressive return objective and capital appreciation of assets.

Investment options:

Invest into alternative assets often require complex due diligence.

Also beware of the conflict of interest with sponsor-company stock.

b) For a DC plan

Risk and return:

Only the plan participants set their own risk, return objectives and constraints.

Plan sponsor may provide educational resources for employee needs to educate himself.

Liquidity:

Each participant must choose investment considering his limited time left until he needs to draw his assets for departures or retirement.

Time horizon:

Given the time horizon for retirement, varies by participant and each participant must value his ability to take risk to match the time left to retirement.

Investment options:

Sponsor must offer a menu of investment options and limit holding of sponsor-company stock for diversification.

14. QFI PM Spring 2022, Question 3

Learning Outcome(s): 2i, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

Solution:

- (a) Calculate the time-weighted rate of return of the surplus portfolio from January 1 to May 1.

Commentary on Question:

Candidates performed below average on this section. While most candidates were able to identify the surplus to liability-backing portfolio transfer as an external cash flow, many also incorrectly classified dividends, coupons and cash reinvestment as external cash flows as well.

Time-weighted rate of return should take into consideration the impact of external cash flows on the market value of the portfolio. The only external cash flow between January 1 and May 1 is the \$10M cash transfer from the surplus portfolio to the liability-backing portfolio.

$$\text{time-weighted return} = \frac{110+10}{115} \cdot \frac{120}{110} - 1 = 13.8\%$$

(b)

- (i) Calculate the overall portfolio return and overall benchmark return.
- (ii) Calculate the active asset class allocation return and active security selection return, assuming interaction returns are folded within security selection.

Commentary on Question:

Candidates performed above average on this section. Most candidates were able to correctly calculate the overall portfolio return and overall benchmark return. Some candidates only calculated active security selection returns without interaction returns. These candidates did not receive full credit.

(i)

$$\begin{aligned}\text{portfolio performance} &= \sum w_{p,i} r_{p,i} = 50\% \cdot 7.5\% + 30\% \cdot 10.0\% + 20\% \cdot 5.0\% \\ &= 7.75\%\end{aligned}$$

$$\begin{aligned}\text{benchmark performance} &= \sum w_{b,i} r_{b,i} = 45\% \cdot 4.5\% + 40\% \cdot 9.0\% + 15\% \cdot 6.0\% \\ &= 6.53\%\end{aligned}$$

(ii)

$$\begin{aligned}\text{active sector allocation return} &= \sum_{i=1}^S (w_{p,i} - w_{b,i})(r_{b,i} - r_b) \\ &= (50\% - 45\%) \cdot (4.5\% - 6.53\%) + (30\% - 40\%) \\ &\quad \cdot (9.0\% - 6.53\%) + (20\% - 15\%) \cdot (6.0\% - 6.53\%) \\ &= -0.375\%\end{aligned}$$

$$\begin{aligned}\text{active security selection return} &= \sum_{i=1}^S w_{b,i}(r_{p,i} - r_{b,i}) \\ &= 45\% \cdot (7.5\% - 4.5\%) + 40\% \cdot (10.0\% - 9.0\%) \\ &\quad + 15\% \cdot (5.0\% - 6.0\%) \\ &= 1.60\%\end{aligned}$$

$$\text{interaction return} = \sum_{i=1}^S (w_{p,i} - w_{b,i})(r_{p,i} - r_{b,i})$$

$$\begin{aligned}
&= (50\% - 45\%) \cdot (7.5\% - 4.5\%) + (30\% - 40\%) \\
&\cdot (10.0\% - 9.0\%) + (20\% - 10\%) \cdot (5.0\% - 6.0\%) \\
&= 0.00\%
\end{aligned}$$

- (c) Assess the performance of the portfolio in meeting its objectives.

Commentary on Question:

Candidates performed above average on this section. Most candidates were able to correctly calculate portfolio and benchmark return correctly. Most candidates also correctly identified the relationship between credit spread return and credit sensitivity but failed to associate carry return with book yield.

Carry return due to passage of time is an indicator of the portfolio's and benchmark's book yield.

$$\begin{aligned}
\text{portfolio carry return} &= 15\% \cdot 1.50\% + 85\% \cdot 3.0\% \\
&= 2.775\% \\
\text{benchmark carry return} &= 30\% \cdot 1.0\% + 70\% \cdot 2.5\% \\
&= 2.050\% \\
\text{net carry return} &= 2.775\% - 2.050\% = 0.725\%
\end{aligned}$$

Since the net carry return is positive, the portfolio is successful in meeting the first objective of exceeding the benchmark in book yield.

Return from credit spread is an indicator of the portfolio/benchmark sensitivity to changes in credit spreads.

$$\begin{aligned}
\text{portfolio credit spread return} &= 85\% \cdot 2.50\% = 2.125\% \\
\text{benchmark credit spread return} &= 70\% \cdot 2.70\% = 1.890\% \\
\text{net credit spread return} &= 2.125\% - 1.890\% = 0.235\%
\end{aligned}$$

The credit spread return of the portfolio is higher than that of the benchmark on an absolute basis, this indicates that the portfolio is more sensitive to credit spread than the benchmark (e.g. due to credit spread compression). Therefore, the portfolio is not meeting the second objective.

- (d) Calculate the active sector allocation return and active security selection return under the new framework.

Commentary on Question:

Candidates performed below average on this section. Many candidates failed to understand the implications on performance and attribution when bond prices are not marked-to-market.

Under the new accounting framework where bond prices are not marked-to-market, only carry return would impact portfolio and benchmark performance.

$$\begin{aligned}
 \text{active sector allocation return} &= \sum_{i=1}^S (w_{p,i} - w_{b,i})(r_{b,i} - r_b) \\
 &= (15\% - 30\%) \cdot (1.00\% - 2.05\%) + (85\% - 70\%) \\
 &\quad \cdot (2.50\% - 2.05\%) \\
 &= 0.225\%
 \end{aligned}$$

$$\begin{aligned}
 \text{active security selection return} &= \sum_{i=1}^S w_{b,i}(r_{p,i} - r_{b,i}) \\
 &= 30\% \cdot (1.50\% - 1.00\%) + 70\% \\
 &\quad \cdot (3.00\% - 2.50\%) \\
 &= 0.500\%
 \end{aligned}$$

$$\begin{aligned}
 \text{interaction return} &= \sum_{i=1}^S (w_{p,i} - w_{b,i})(r_{p,i} - r_{b,i}) \\
 &= (15\% - 30\%) \cdot (1.50\% - 1.00\%) + (85\% - 70\%) \\
 &\quad \cdot (3.00\% - 2.50\%)
 \end{aligned}$$

= 0.00%

15. QFI PM Spring 2022, Question 6

Learning Outcome(s): 2k, 1b

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19; The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011 Ch 10, Ch 18

Commentary on Question:

This question tests the candidate's understanding of factors affecting ALM. Overall, candidates performed as expected on this question.

Solution:

- ~~(a) Describe four ways in which insurers may take excessive risks that could impact investment decisions.~~

~~Commentary on Question:~~

~~The candidates performed as expected on this section. Most candidates received credit for describing insurers changing their asset allocation towards risky investments or charging insufficient premiums for products. Some candidates only described multiple ways in which insurers could allocate assets towards risky investments.~~

- ~~1.—Insurer charges insufficient premium or has imprudent underwriting policy, which could rapidly expand volume of business.~~
- ~~2.—Insurer changes asset allocation toward riskier investment portfolio.~~
- ~~3.—Reduce equity capital endowment to the minimum regulatory capital required, which leads to higher probability of insolvency.~~
- ~~4. Fail to sufficiently manage risks through reinsurance arrangements.~~

- (b) Describe three measures used to examine the performance of an investment taking its risk into account.

Commentary on Question:

The candidates performed as expected on this section. Most candidates received partial credit for listing and succinctly describing the Treynor and Sharpe Ratios. Most candidates did not discuss systematic vs. unsystematic risk.

- Jensen's Alpha – measures difference between expected return of an investment and the investment's fair rate of return. Often used to evaluate fund manager performance and can be seen as measure of how much an investment beats the market.
- Treynor ratio – measures the excess return over the risk-free rate per unit of market risk.
- Sharpe ratio – used to compare different investment opportunities with different risk levels, since it measures expected excess return per unit of risk.
- Jensen's Alpha and Treynor ratio are built on systematic risk. Fund managers are expected to eliminate unsystematic risk in the portfolio by diversifying, thus leaving only systematic risk to manage.

(c)

- (i) Calculate the Sharpe ratio and Treynor ratio for each fund.
- (ii) Recommend which fund to invest in based on your results from part (c) i).

Commentary on Question:

The candidates performed brilliantly on this section. Many candidates received credit for correctly recommending Fund A, but did not recognize that the portfolio is well-diversified and, thus, should use Treynor ratio as the comparison basis.

(i)

- Treynor Ratio = [expected return – risk free rate]/systematic risk
- Sharpe Ratio = [expected return – risk free rate]/standard deviation
- Manager A – Treynor Ratio = $[10\% - 3\%] / 1.25 = 5.6\%$, Sharpe Ratio = $[10\% - 3\%] / 5\% = 1.4\%$
- Manager B – Treynor Ratio = $[12\% - 3\%] / 1.75 = 5.14\%$, Sharpe Ratio = $[12\% - 3\%] / 6\% = 1.3\%$

(ii) Recommend manager A, since Treynor ratio is higher, which suggests that the amount of excess return per unit of systematic risk is greater. Treynor ratio should be used as the metric rather than Sharpe ratio, since it's a well-diversified portfolio.

(d)

(i) Explain why a prolonged low interest rate environment poses additional risk.

(ii) Critique your assistant's suggestions.

Commentary on Question:

The candidates performed as expected on this section. Most candidates received partial credit for describing the risks associated with the recommendations, but did not explain how the risks apply in this case.

(i)

- Low interest rates constrain profits by generating insufficient investment returns.
- Value of liabilities increases when applying a reduced rate for discounting.

(ii)

- ~~Infrastructure~~ Private equity and hedge fund investments provide attractive returns and are a good match for long duration liabilities, such as whole life and pension liabilities. However, the optionality and uncertainty in mortality introduces liquidity risk that is inappropriate to be matched with long-term, illiquid assets like ~~private equity and hedge funds~~ infrastructure. Capital requirements are also substantially higher for infrastructure investments.
- Allocating to emerging market debt exposes the company to currency risk, and, thus, the interest earned is not risk-free. When investing in an asset denominated in a foreign currency, the currency risk should be hedged by purchasing exchange rate swaps, which translates into earning a rate close to Treasury rates anyway.
- Equities generally generate higher yields and also hedge against inflation and are tax-efficient. However, the capital charge is substantially higher

than that for high quality bonds. Duration mismatch will produce additional regulatory challenges in terms of cash flow and stress testing.

16. QFI PM Spring 2022, Question 9

Learning Outcome(s): 2b, 2c, 2d

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 6

Commentary on Question:

This question tests the fundamentals of an investment policy statement. Candidates are asked to analyze and recommend an investment policy subject to constraints

Solution:

- (a) List eight typical elements of an investment policy statement.

Commentary on Question:

Candidates performed above average on this part. Many candidates received full credit by providing the typical elements of the investment policy.

- Define the investor
- Define the structure
- Responsibilities for investment policy, including execution and monitoring
- Review process
- Responsibility for determining asset allocation
- Describe overall investment objective
- State risk and return requirements
- Define investor risk tolerance
- Define any other investment constraints
- Establish performance monitoring
- Define process for rebalancing of portfolios to targets
- ~~A brief client description~~
- ~~The purpose of establish policies and guidelines~~

- ~~The duties and investment responsibilities of parties involved, particularly those relating to fiduciary duties, communication, operational efficiency, and accountability. Parties involved include the client, any investment committee, the investment manager, and the bank custodian.~~
- ~~The statement of investment goals, objectives, and constraints.~~
- ~~The schedule for review of investment performance as well as the IPS itself.~~
- ~~Performance measures and benchmarks to be used in performance evaluation.~~
- ~~Any considerations to be taken into account in developing the strategic asset allocation.~~
- ~~Investment strategies and investment style(s).~~
- Guidelines for rebalancing the portfolio based on feedback.

- (b) Describe the return objectives and liquidity requirements of the ABC pension plan

Commentary on Question:

Candidates performed as expected on this part. Most candidates were able to identify that two distinct groups of employees have different liquidity needs and should be addressed separately.

Return objective:

Since the pension fund was earning 6.5% historically and is just funded at 100%, the return objective is to maintain at least 6.5% to avoid the pension fund from being under funded.

Liquidity requirements:

For the older workforce, the liquidity requirement is short term. Therefore, the assets to support this part of pension liability should be relatively liquid.

For younger workforce, the liquidity requirement is long term. Therefore, the assets to support this part of pension liability can be relatively illiquid in order to pursue excess return

The risk tolerance for the liquid portion of the pension fund is low since the liability will be due soon and the pension fund is just 100% funded with no

surplus. The risk tolerance for illiquid portion of the pension fund is relatively high due to long duration.

- (c) Evaluate whether the proposal fulfills four standard investment constraints.

Commentary on Question:

Candidates performed below average on this part. Many candidates did not provide the investment constraints and relate how BitCoin was suitable under them. Those candidates that did analyze BitCoin's suitability under each constraint received full credit.

Liquidity: Liquidity requirement consist of both liquid and illiquid assets. BitCoin is actively traded and relatively liquid. The investment strategy fulfills the liquidity constraint.

Time horizon: The time horizon for the pension fund is long term. Since BitCoin has only came about in recent years and has no long-term history, it is unclear whether investing in BitCoin can fulfill the time horizon requirement.

Tax concerns: Investment income is tax-exempt for pension funds.

Regulatory factors: No information to decide. However, given the volatility of the BitCoin, it might not be suitable for pension funds.

Unique circumstances: Since BitCoin is not traded using the local currency, investing in BitCoin does introduce currency risk.

17. QFI PM Spring 2022, Question 16

Learning Outcome(s): 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 10

Commentary on Question:

This question tests a variety of methods to manage a portfolio against liabilities, testing concepts relating to cashflow matching and duration matching. Successful candidates identified the relation between cashflows and funding status and recommended solutions, then proceeded calculating and comparing asset and liability durations.

Solution:

- (a) Calculate the unfunded liability position of your matching strategy at the end of each of years 1-3 for the liabilities and the supporting assets.

Commentary on Question:

Candidates performed above average on this section. Most candidates identified the magnitude of the coupon payments and compared it to the liability cash flows as required. Failing to recognize the maturity payment in year three was a common mistake.

The coupons from bonds 1, 2, and three are \$0.35, \$0.13, and \$0.01 million respectively from multiplying their par values and coupon rates, or \$0.49 million per annum. Since the liability is 1 each year there is a deficiency of \$0.51 million in years 1 and 2. There is a maturity payment of \$1 million in year 3, thus the fund is not underfunded in that year.

- (b) Calculate the minimum value of bonds to purchase to fully cashflow match the liabilities.

Commentary on Question:

Candidates performed as expected on this section. Many candidates recommended purchasing the thirty-year bond to fill the deficit and performed a calculation on the number of bonds needed. Recommending a bond with a lower coupon rate was a common mistake.

The company should purchase more of the thirty-year bond to fill the deficit because that has the highest coupon payment. $\$0.51 / 0.035 = 14.57$ bonds are needed.

- (c) Evaluate if cashflow matching is an appropriate method for these liabilities.

Commentary on Question:

Candidates performed below average on this section. Most candidates made the wrong recommendation that cash flow matching was inappropriate.

Cashflow matching works well in this case since the liabilities are known in advance. Available assets can be found to match the fixed stream of cashflows.

- (d) Calculate the amount of assets above that you will need to purchase to immunize this net asset/liability position.

Commentary on Question:

Candidates performed as expected on this section. Most candidates calculated the dollar duration of assets and liabilities correctly and recognized the difference. Occasionally, they miscalculated the amount to purchase.

The dollar duration of assets is $550 \times 8 \times 0.01 = 44$. Similarly, liability duration is $540 \times 12 \times 0.01 = 64.8$. This difference of 20.8 is hedged by purchasing $20.8 / 0.08 = \$260$ million of assets.

- (e) Calculate the number of full future contracts that would be needed to be bought or sold to successfully immunize the net position.

Commentary on Question:

Candidates performed above average on this section. Many candidates received full credit. Common mistakes included calculation errors in the final answer.

The formula is dollar duration to hedge / asset dollar duration $\times$ price of the bond to hedge $\times$ CTD factor. We know the dollar duration to hedge from part d: \$20.8 million. Substituting, the answer is $20.8 / (7 \times 0.01 \times 10) \times 1.2 = 35.66$, requiring 36 contracts.

- (f) Calculate the number of full future contracts that would need to be bought or sold to achieve this.

Commentary on Question:

Candidates performed as expected on this section. Most candidates recognized the correct formula and calculated an answer. Receiving full credit was not uncommon. Calculation errors were a common reason full credit was not achieved.

The formula needed is $(\text{Target} - \text{initial duration}) \times 550 / (\text{duration of hedge contract} \times \text{price of CTD bond}) \times \text{CTD factor}$. Substituting, the answer is $-2 \times 550 / (7 \times 10) \times 1.2 = -18.57$, 19 contract sales are required.

18. QFI PM Fall 2022, Question 2

Learning Outcome(s): 2i, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

Commentary on Question:

This question aims to test candidates' knowledge on apply performance measurement methodologies to various asset portfolios, and assess and interpret performance attribution metrics for a given asset or portfolio. In general, the candidates performed as expected on this question.

Solution:

- (a) Critique your supervisor's assessment.

Commentary on Question:

The candidates performed below average on this section. This question aims to test candidates' knowledge on apply performance measurement methodologies to fixed income portfolio. Most candidates correctly identified that the manager's assessment is not correct, but very few candidates pointed out the correct missing components.

I do not agree with the manager's assessment.

The total return of a fixed-income portfolio can be attributed to the external interest rate effect, on one hand, and the management effect, on the other. The manager's assessment is missing the components attributable to

external interest rate effect which include return on the benchmark assuming no change in the forward rates and return due to changes in forward rates.

- (b) Derive a micro attribution analysis by calculating the value-added returns due to section allocation, within-section selection, and allocation/selection interaction.

Commentary on Question:

The candidates performed as expected on this section. This question aims to test candidates' knowledge of assessing and interpreting performance attribution metrics for a given asset or portfolio. Many candidates did the correct calculation but got the decimal place wrong. For example, some candidates calculated Pure Sector Allocation as 0.0818% instead of the correct 8.18%.

Pure Sector Allocation = $\text{SUMPRODUCT}(\text{Weight Diff}, \text{Index Sector Return} - \text{Total Index Return}) / 100 = 8.18\%$

Allocation/Selection Interaction = $\text{SUMPRODUCT}(\text{Weight Diff}, \text{Port Sector Return} - \text{Index Sector Return}) / 100 = 0.89\%$

Within-Sector Selection = $\text{SUMPRODUCT}(\text{Index Weight} (\%), \text{Port Sector Return} - \text{Index Sector Return}) / 100 = -8.45\%$

Port Return - Index Return = Weighted Average Portfolio Return - Weighted Average Index Return = 0.62%

Show your work here:

Sector	Portfolio Weight (%)	Index Weight (%)	Portfolio Return (%)	Index Return (%)	Weight Diff	Index Sector Return - Total Index Return	Port Sector Return - Index Sector Return
Government bonds	50.8	54.5	2.4	2.4	-3.7	-0.715	0
Corporate bonds	40.2	39	3.5	3.8	1.2	0.685	-0.3
Mortgaged backed securities	9	6.5	5.5	5	2.5	1.885	0.5
Weighted Average			3.1212	3.115			

- (c)

- (i) Calculate active returns due to timing, security selection, and other items.
- (ii) Calculate how much total active management by the investment has benefited or cost the plan over the 15-year period.

Commentary on Question:

The candidates performed above average on this section. This question aims to test candidates' knowledge of the determinants of portfolio performance. The candidates performed better on the first section than the second section. Some candidates got the correct numbers during their calculation, but did not map them to the correct category.

- i. Timing = II – I = 11.12% - 12.25% = -1.13%
 Selection = III- I = 11.5%-12.25% = -.75%
 Other = IV – III – II + I = 8% - 11.5%-11.12%+12.25% = -2.37%
- ii. Total = IV – I = 8%-12.25% = -4.25%

19. QFI PM Fall 2022, Question 3

Learning Outcome(s): 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

Commentary on Question:

The question tests the evaluation and management of equity portfolios in a pension fund and asset allocation in a shifting economic environment.

Solution:

- (a) Assess the relative performance of the three managers A, B, and C.

Commentary on Question:

The candidates performed above average on this section. Most candidates used the information ratio to evaluate manager performance. Most errors occurred in determining the correct return benchmark or the correct method to adjust for risk. To receive full credits, candidates needed to define the information ratio.

Information Ratio = True Active Return / True Active Risk

Manager true active return = Manager return – Benchmark return

Benchmarks are based on manager orientation. Manager A uses Index Y. Manager B uses Index Y Value. Manager C uses Index Y Momentum.

Manager true active return calculations:

Manager A true active return = 11% - 10% = 1%

Manager B true active return = 14% - 12% = 2%

Manager C true active return = 14% - 13% = 1%

Total active risk = $[(\text{True active risk})^2 + (\text{Misfit active risk})^2]^{0.5}$

Solve the equation for true active risk.

True active risk = $[(\text{Total active risk})^2 - (\text{Misfit active risk})^2]^{0.5}$

True active risk calculations:

Manager A true active risk = $[0.02^2 - (0.01)^2]^{0.5} = 1.73\%$

Manager B true active risk = $[0.03^2 - (0.02)^2]^{0.5} = 2.24\%$

Manager C true active risk = $[0.04^2 - (0.03)^2]^{0.5} = 2.65\%$

Information ratio calculations:

Manager A Information Ratio = 1% / 1.73% = 0.58

Manager B Information Ratio = 2% / 2.24% = 0.89

Manager C Information Ratio = 1% / 2.65% = 0.38

Manager B is best performing due to highest information ratio, followed by a and c.

20. QFI PM Fall 2022, Question 6

Learning Outcome(s): 2e

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 9

Commentary on Question:

The question tests the candidates' knowledge of risk factors of a bond fund and immunization strategies. The candidates performed below average on this question.

Solution:

- (a) Identify two advantages and four disadvantages of investing in emerging market debt.

Commentary on Question:

The candidates performed as expected on this section. Most candidates identified two advantages of emerging market debt. Many candidates also identified some disadvantages. Points were not awarded for generic answers that are not specific to emerging market debt (e.g. legal risk).

Advantages:

- Potential for consistent, attractive returns.
- Emerging market sovereigns have advantage over private corporations which can reverse an adverse situation (e.g. can cut spending or raise taxes).

Disadvantages:

- Volatility can be high.
- Returns can be negatively skewed.
- Lower transparency, court-tested law or regulations.
- Non-standard covenants.

- (b) Explain three factors that can drive the repo rate to be a drag on the fund's return.

Commentary on Question:

The candidates performed as expected on this section. Most candidates identified some of the points that influence the repo rate, and subsequently the impact on the fund's return.

The repo rate will be a drag on the funds return if the repo rate increases. The repo rate can be affected negatively (increase) by the following factors:

- Decrease in the quality of securities of the fund.
- Using repos with longer maturity.
- Interest rates rise generally.

- (c) Calculate the return on the bond holdings that would have resulted in the complete exhaustion of the fund over the past year.

Commentary on Question:

The candidates performed below average on this section. While many candidates correctly calculated the leverage ratio of the fund, a common mistake was to interpret "complete exhaustion of the fund" as the fund generating a return of 0% instead of fully depleting its market value (i.e. returning -100%).

First we find the leverage of the fund (B/E):

$$R_p = r_f + B/E(r_f - k)$$

We need to solve for B/E:

$$\frac{B}{E} = \frac{(R_p - r_f)}{(r_f - k)} = \frac{8\% - 3.5\%}{3.5\% - 2\%} = 3$$

i.e. the fund borrowed \$3 for every \$1 of equity.

The fund would become 0 when $R_p = -100\%$. We solve for r_f :

$$-1 = 4r_f - 3k$$

$$r_f = (3k - 1)/4$$

$$r_f = -23.5\%$$

- (d) Design an immunization strategy to manage the investment portfolio for this GIC contract.

Commentary on Question:

The candidates performed poorly on this section. Most candidates failed to provide a strategy that immunizes the portfolio against changes in the yield curve. Partial credits were awarded to candidates whose solution involved using derivative strategies to hedge the liability interest rate exposure.

The proposed strategy is:

Find the implied guaranteed interest rate offered in the GIC contract:

$$100*(1+i)^2 + 60*(1+i) = 166$$

$$i = 2.29\%$$

Since the initial yield curve is 2.40%, it's feasible to create an immunized portfolio.

We can split the initial \$100 million into two components:

- (I) Invest \$40 million of the initial premium to create an asset with duration of 2 years to match a portion of the GIC maturity requirement. This eliminates interest rate risk for a portion of the liability.
- (II) Invest \$60 million of the initial premium to create an asset with duration of 3 years. At the end of the first year, any decline (rise) in the interest rates at which the “year 2 premium” is to be invested will be offset by a corresponding increase (decrease) in the value of the initial holdings. This part of the portfolio is rebalanced at that time by selling the actual holdings and investing the proceeds, together with the “year 2 premium”, in a portfolio with a duration of 1 year to match the GIC maturity date.

The combined effect of (I) and (II) immunizes the total investment portfolio against the interest rate risk.

21. QFI PM Fall 2022, Question 13

Learning Outcome(s): 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 19

Commentary on Question:

This question tested the candidates' understanding of investment strategies and manager contribution to portfolio return, along with characteristics of different asset types and knowledge of ESG criteria in asset selection.

Solution:

- (a) Construct a portfolio with manager B and manager C that has an expected return above 8%, an active risk below 2% and an information ratio above 4.2, you can't "short" a manager.

Commentary on Question:

The candidates performed above average on this section. Candidates who attempted this problem or recognized that no feasible solution exists were awarded full or close-to full credit. A very small number of points were deducted from candidates that used an incorrect active risk formula or showed no work. Formulas within Excel did not need to be separately identified for full credit. If the formula could be determined by clicking on the cell and reading the formula bar, that was satisfactory.

Information Ratio (IR) = mean active return / active risk

The feasible solution does not exist using the parameters given.

- (b) Recommend an appropriate benchmark for each manager.

Commentary on Question:

The candidates performed brilliantly on this section. Most candidates correctly identified all six appropriate benchmarks, although some candidates lost credit for not providing additional justification for their recommendation.

A: XYZ Value – Low P/E is a substyle of value investing style, implies stock is cheap.

B: XYZ Growth – High P/E is usually linked to the growth style.

C: XYZ Value – This is a contrarian style, which is a substyle of value investing.

D: XYZ Small Cap – Focuses on stocks with very low market capitalizations.

E: XYZ Energy – Energy market oriented, specialized in the energy sector.

F: XYZ: Commodity – Commodity market oriented, specialized in agriculture firms.

- (c) Analyze whether it is worth hiring manager C compared to index investing.

Commentary on Question:

The candidates performed poorly on this section. Very few candidates calculated true active risk, true active return, or the true information ratio. While correctly calculating the true information ratio should have led candidates to recommend hiring manager C, partial credit was awarded to candidates who provided any recommendation and justified their answer in the context of added return vs added risk. Additionally, candidates were not penalized for using an information ratio formula that was based on the formula used in part (a).

In order to solve this problem, we should calculate the true information ratio
= (true active return)/(true active risk).

True Active Return = $10\% - 9\% = 1\%$

Misfit Active Return = $9\% - 8\% = 1\%$

Misfit Active Risk = 2%

True Active Risk = $\sqrt{(5\%^2 - 2\%^2)} = 4.58\%$

True Information Ratio = $1\% / 4.58\% = .218$

Because Manager C has a positive true active return and true information ratio, he is adding value and we should hire them.

- (d) Justify your decision. (Hint: Explain how manager F may represent more risk than the statistics are telling and how manager E may represent more opportunity.)

Commentary on Question:

The candidates performed as expected on this section. Most candidates recognized the importance of ESG criteria. Many candidates provided only a brief response to this question and were only awarded partial credit. A wide range of answers were also acceptable, provided the candidate justified their answers.

Some candidates provided quantitative answers in response to this question without expanding on the ESG components or the qualitative differences between E and F. While this was awarded partial credit, the Hint was written to point candidates in the direction of why F may represent “more risk than the statistics are telling and how manager E may represent more opportunity”. Thus, a more qualitative answer was expected.

Manager F may represent more risk because consumers and the public are continuing the question the role of agriculture in driving deforestation and climate change. Additionally, agrochemical companies could be involved in other controversial practices such as the use of GMO tech and pesticides. Agrochemical and agricultural companies could face the risk of:

- Adverse publicity
- Public protest
- Consumer boycott
- Government regulation

Comparatively, Manager E satisfies environmental, social, and governance (ESG) criteria that may benefit positively from future regulations and consumer tastes and behavior. This has additional benefits for a long-term oriented investment. For that reason, Manager E has substantially more opportunity for investment than Manager F, despite the higher return shown by current statistics.

22. QFI PM Fall 2022, Question 17

Learning Outcome(s): 2b

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors

Commentary on Question:

This question tests candidates understanding of investment policies.

Solution:

- (a) —
 - (i) — Identify each product
 - (ii) — Describe how each product would require portfolio construction differently.

Commentary on Question:

The candidates performed above average on this section. Most candidates identified the two products. Candidates commented on the relative duration and liquidity need between the two portfolios, however often candidates did not meet both.

Product A is the active VA business since there is cash in-flow from premium and cash out-flow for commissions.

Product B is the legacy business since there is no premium payment and large benefit payments.

For the VA, premium inflow is heavily related to benefits and contracts are in earlier durations. The asset base is small with little investment income and few bonds maturing. Portfolio construction should be oriented towards a robust, diversified portfolio with durations to match future liabilities.

For the closed block UL product, contracts will be paid out in the near future. Positive cash flow comes from investment income and maturity payments. Investments should be oriented towards building an adequately liquid, high cash flow portfolio with relatively short duration.

- (b) — The portfolio backing the legacy block of business contains several bonds with five years remaining until maturity with a book yield of 6%. The current market yield for a 5-year bond is 4%. It is estimated that the liability duration for this block is less than ten years. The portfolio manager thinks we can sell these bonds to harvest a capital gain.

Critique the proposal.

Commentary on Question:

The candidates performed below average on this section. Most candidates identified that the capital gain would result in a mismatched portfolio and reinvestment would be required in a lower rate environment. Some candidates identified the tax implications. Few candidates described the EV impact from the sale.

In general, selling these bonds could shorten the duration of the portfolio, depending on what is done with the proceeds, creating a potential duration mismatch.

~~The company may be constrained by EV/EVA, which means the present value of distributed earnings need to be intact when a security is sold.~~

~~When the bond is sold it would create a capital gain. The proceeds need to be invested to produce the future cash flows so the EV/EVA is intact.~~

~~If we sell the bond and replace it with a new 10-year bond for EV/EVA purpose, it will lengthen the duration of the portfolio~~

~~Capital gains are normally subject to tax, therefore the proceeds would be insufficient to produce the desired cash flow and EV/EVA will be decreased.~~

~~—— However since tax is calculated on consolidated basis and gains and losses are netted against each other, it may be recommended to sell to realize the gain.~~

~~—— The sale may also have a negative impact on credited rates.~~

~~—— We should also be careful not to reduce a portfolio's credit quality, cash flow matching or maturity structure, or increase concentration risk in a single issuer.~~

(c) Describe typical constraints in an IPS.

Commentary on Question:

The candidates performed brilliantly on the section. Most candidates identified the key constraints in the IPS. Candidates earned part marks for incomplete solutions.

Define an evaluation horizon for achievement of performance objectives.

Identify any requirements for maintaining liquidity.

Identify tax consideration that will affect investment decision making.

Specify any policies related to leverage.

Identify any restrictions on investment in foreign securities or investment.

Specify a policy on foreign currency management, if relevant

- (d) Describe how an IPS would document governance.

Commentary on Question:

The candidates performed brilliantly on this section. Most candidates identified components of the IPS governance with many candidates earning full marks.

An IPS can document governance in following ways:

Specify who is responsible for determining investment policy, executing investment policy, and monitoring the results of implementation of the policy.

Describe the process for reviewing and updating the IPS.

Describe the responsibility for engaging and discharging external advisers.

Describe the roles and responsibilities of board and staff.

Assign responsibility for determination of asset allocation, including inputs used and criteria for development of input assumptions.

Assign responsibility for risk management, monitoring and reporting.

23. QFI PM Spring 2023, Question 1

Learning Outcome(s): 2e, 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 9, Ch 10

Commentary on Question:

This question tests the topics in constructing and managing portfolios of fixed income investments under various strategies, including indexing and target return.

Solution:

- (a) Assess which index fund (or funds) from the above table is most suitable for each of the three types of employees: “young”, “mid-aged”, and “near retirement”.

Commentary on Question:

Candidates performed as expected on this part. Many were able to recommend one fund (and some were able to recommend more than one funds) to each of the three types of employees.

For young employees: the level of risk aversion is low, and the time-to-retirement is long. Therefore, the investment objective is mainly driven by achieving a long-term higher return in relation to bearing a higher risk. Fund A, B and D are suitable. Fund C may not be suitable

For mid-aged employees: both the level of risk aversion and time-to-retirement fall to medium range, so all of the four funds could be suitable.

For “near retirement” employees: the level of risk aversion is high, and time-to-retirement is short. Therefore, the investment objective is mainly driven by protecting the capital from the market loss. Fund B, C and D are suitable. Fund A may not be suitable.

- (b) Explain how six different approaches could be used to reduce the tracking error.

Commentary on Question:

Candidates performed poorly on this part. Though some were able to correctly identify the approaches to reduce the tracking error, many answers were not directly related to tracking error reduction.

1. Reduce the duration mismatch between the portfolio and the benchmark. This helps when the yield curve exhibits parallel shift
2. Reduce the mismatch of key rate duration and the distribution of cash flows between the portfolio and the benchmark. This helps when the yield curve exhibits non-parallel shift.
3. Reduce the mismatch of “sector weight” and “quality weight” between the portfolio and the benchmark. This helps when the portfolio contains the same sector and quality exposure as the index. For example, a missing sector in the portfolio could lead to large tracking error if the sector is the main driver of the index movement.

4. Reduce the mismatch of sector duration. This ensures that the change in sector spreads has the same impact on both the portfolio and the index.
 5. Reduce the mismatch of credit spread duration. Changes in the spread between qualities of bonds will also affect the index return. The easiest way to ensure that the indexed portfolio closely tracks the benchmark is to match the amount of the index duration that comes from the various quality categories.
 6. Reduce the mismatch of sector/coupon/maturity cell weight with respect to callable bonds. This is more feasible than matching the convexity of the index especially for callable bonds which tend to be illiquid and expensive to trade.
 7. Reduce the mismatch of issuer exposure. If the portfolio contains too few securities than the index, event risk could lead to large tracking error.
- (c) Propose two different trades (without using derivatives) that could be done at time t to meet the target dollar duration requirement.

Commentary on Question:

Candidates performed above expectations on this part. Two definitions of the “portfolio dollar duration” below were accepted as long as the proposed trade met the requirements:

- a. Based on the syllabus material, the weighted average of dollar duration of each of the underlying securities.*
- b. Based on the common industry practice, the sum of the dollar duration of each of the underlying securities.*

Since many trades were possible, shown below are just two examples.

Using the syllabus definition of portfolio dollar duration

	A	B	C	D	E	F	G	H	I
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

Portfolio at the inception					Portfolio at some time t after the inception				
	<u>Market Value</u>	<u>Duration</u>	<u>Bond Weight</u>			<u>Market Value</u>	<u>Duration</u>	<u>Bond Weight</u>	
Bond1	\$10,800,000	1.25	20.8%		Bond1	\$10,260,000	0.6	19.8%	
Bond2	\$10,300,000	4.45	19.9%		Bond2	\$10,403,000	4.1	20.1%	
Bond3	\$10,600,000	5.05	20.5%		Bond3	\$10,812,000	4.55	20.9%	
Bond4	\$10,000,000	5.65	19.3%		Bond4	\$10,050,000	5.05	19.4%	
Bond5	<u>\$10,100,000</u>	<u>5.95</u>	<u>19.5%</u>		Bond5	<u>\$10,201,000</u>	<u>5.55</u>	<u>19.7%</u>	
Total	\$51,800,000		100.0%		Total	\$51,726,000		100.0%	
Total dollar duration at inception --->			\$455,073		Total dollar duration at time t --->			\$411,082	

Use formula:

=SUMPRODUCT(C4:C8, D4:D8, E4:E8)*0.01

Use formula:

=SUMPRODUCT(G4:G8, H4:H8, I4:I8)*0.01

Proposal 1:

Purchase bonds proportionally to restore the target dollar duration of \$455,073.

That is, each of the five bond position is increased by 10.7% ($=455073/411082 - 1$)

Proposal 2

Adjust the controlling position of the portfolio. Since Bond 1 has the shortest duration, it can be designated as the controlling position and its position needs to be reduced by 37.9% (from \$10,260,000 to \$4,092,661) to restore the portfolio target duration

	<u>Market Value</u>	<u>Duration</u>	<u>Bond Weight</u>
Bond1	\$4,092,661	0.6	9.0%
Bond2	\$10,403,000	4.1	22.8%
Bond3	\$10,812,000	4.55	23.7%
Bond4	\$10,050,000	5.05	22.1%
Bond5	<u>\$10,201,000</u>	<u>5.55</u>	<u>22.4%</u>
Total	\$45,558,661		100%
Total dollar duration at time t --->			\$455,073

Use formula:

Can use trial-and-error or "goal seek" function to arrive at this number

Use formula:

=SUMPRODUCT(G22:G26, H22:H26, I22:I26)*0.01

Using the common industry practice of portfolio dollar duration

	A	B	C	D	E	F	G	H	I
1									
2		Portfolio at the inception				Portfolio at some time t after the inception			
3			<u>Market Value</u>	<u>Duration</u>			<u>Market Value</u>	<u>Duration</u>	
4		Bond1	\$10,800,000	1.25		Bond1	\$10,260,000	0.6	
5		Bond2	\$10,300,000	4.45		Bond2	\$10,403,000	4.1	
6		Bond3	\$10,600,000	5.05		Bond3	\$10,812,000	4.55	
7		Bond4	\$10,000,000	5.65		Bond4	\$10,050,000	5.05	
8		Bond5	\$10,100,000	5.95		Bond5	\$10,201,000	5.55	
9		Total	\$51,800,000			Total	\$51,726,000		
10		Total dollar duration at inception --->			\$2,294,600	Total dollar duration at time t --->			\$2,053,710
11		Use formula:				Use formula:			
12		=SUMPRODUCT(C4:C8, D4:D8)*0.01				=SUMPRODUCT(G4:G8, H4:H8)*0.01			
13		Proposal 1:							
14		Purchase bonds proportionally to restore the target dollar duration of \$2,294,600.							
15		That is, each of the five bond position is increased by 11.7% (=2294600/2053710 – 1)							
16									
17		Proposal 2							
18		Adjust the controlling position of the portfolio. Since Bond 5 has the longest duration, it can be designated as the controlling							
19		position and its position needs to be increased by 42.55% (from \$10,201,000 to \$14,541,369) to restore the portfolio target duration							
20			<u>Market Value</u>	<u>Duration</u>			<u>Market Value</u>	<u>Duration</u>	
21		Bond1	\$10,260,000	0.6		Bond1	\$10,260,000	0.6	
22		Bond2	\$10,403,000	4.1		Bond2	\$10,403,000	4.1	
23		Bond3	\$10,812,000	4.55		Bond3	\$10,812,000	4.55	
24		Bond4	\$10,050,000	5.05		Bond4	\$10,050,000	5.05	
25		Bond5	\$14,541,369	5.55		Bond5	\$14,541,369	5.55	
26		Total	\$56,066,369			Total	\$56,066,369		
27		Use formula:				Use formula:			
28		=G8+100*(E10 - I10)/H8				=SUMPRODUCT(G21:G25, H21:H25)*0.01			
29									
30									

- (d) Calculate the duration of the cheapest-to-deliver bond, indicating if the futures trade is a “buy” or “sell”.

Commentary on Question:

Candidates performed as expected. Full credit was given when either of the two “portfolio dollar duration” definition was used, as long as the resulting duration of the cheapest-to-deliver bond was computed correctly.

Use the formula below to calculate the duration of the cheapest-to-deliver (CTD) bond

$$Duration_{CTD} = \frac{Target\ dollar\ duration - Current\ dollar\ duration}{\#of\ Futures\ contract * Price_{CTD}} * ConversionFactor$$

If using the syllabus definition of portfolio dollar duration:

$$Duration_{CTD} = \frac{455073 - 411082}{6 * 100000 * 0.01} * 1.16 = 8.5$$

If using the common industry practice of portfolio dollar duration:

$$Duration_{CTD} = \frac{2294600 - 2053710}{6 * 100000 * 0.01} * 1.16 = 46.57$$

The trade is to “buy” futures in order to increase the current portfolio dollar duration to its target level.

24. QFI PM Spring 2023, Question 4

Learning Outcome(s): 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 10

Solution:

- (a) Recommend the use of accumulated benefit obligation (ABO) or projected benefit obligation (PBO) to calculate the funding ratio.

Commentary on Question:

The candidates performed as expected on this section. Most candidates did well recommending PBO, but almost no candidate brought up the specific point that PBO is a reasonable measure of the pension liability for a going concern that does not anticipate terminating its DB plan.

The ABO is effectively the present value of pension benefits, assuming the plan terminated immediately such that it had to provide retirement income to all beneficiaries for their years of service up to that date (accumulated service).

The PBO projects future compensation increases if the benefits are defined as being tied to a quantity such as final average pay.

The PBO is a reasonable measure of the pension liability for a going concern that does not anticipate terminating its DB plan.

Should use PBO due to above explanation.

- (b) Explain why the split between retired-lives and active-lives is important when assessing the funding status of the DB pension plan.

Commentary on Question:

The candidates performed as expected on this section. Most candidates identified that retired lives cause the pension fund's liquidity requirements to go up. But many candidates did not note that a plan with a greater percentage of retirees has a shorter average duration of future pension liabilities.

Because retirees are currently receiving benefits, the greater the number of retired lives, the greater the cash flows out of the fund each month, and thus the higher the pension fund's liquidity requirement.

A plan with a greater percentage of retirees generally has a shorter average life or duration of future pension liabilities.

- (c) Describe the implications of the above information for the plan's risk objective.

Commentary on Question:

The candidates performed as expected on this section. Most candidates made the association of lower debt ratio to higher risk tolerance correctly, but many candidates did not identify the last factor below.

Workforce characteristics: the workforce age is relatively old, so the duration of plan liability is shorter, and the plan has less risk tolerance.

Funding status: plan is underfunded ($\$300/\$400 = 75\%$), which implies a lower risk tolerance.

Financial status: Lower debt ratio implies greater risk tolerance.

Common risk exposure: The plan's portfolio and the company's operating results are correlated, which limits the risk tolerance.

- (d) Recommend an updated return objective.

Commentary on Question:

The candidates performed below average on this section. Most candidates made the suggestion to increase the objective return. However, almost no candidate noted that a well-funded plan can be in a position of generating negative pension expense.

Recommend increasing the objective return. The plan is now overfunded, and the younger workforce age reduces the liquidity risk. A well-funded plan can be in a position of generating negative pension expense as the senior management expects.

- (e) Describe strategies that could address management's concerns.

Commentary on Question:

The candidates performed below average on this section. Most candidates suggested using ALM or liability driven investment approach as an appropriate objective. However, many candidates did not mention diversifying risk as a strategy to address management's concerns.

Pension portfolio should diversify risk relative to the sponsor's operating activities. In this specific scenario, the plan should invest more in non-energy related sectors.

Because pension plan liabilities are interest rate sensitive, pension plan sponsors emphasizing an ALM approach tend to make more intensive use of

interest-rate-sensitive securities (in particular, bonds) than would otherwise be the case.

25. QFI PM Spring 2023, Question 7

Learning Outcome(s): 1b, 2l

Source Materials: Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014, Ch 12, Ch 14; INV101-105-25: Addressing Built-in Biases in Real Estate Investment

Commentary on Question:

This question is concerned with real estate investment and behavioral finance implication.

Solution:

- (a) Contrast the valuations of REIT and direct investing from both the micro and the macro perspectives.

Commentary on Question:

The candidates performed poorly on this section. Most candidates received partial credit for mentioning of differences as to cash flow and liquidity of REIT. Successful candidates were able to contrast key elements for each perspective. The key reasonable explanation was the magnitude of the difference in cash flow income and the time frame at the micro-level and the price valuation considerations of REIT at the macro-level.

The difference between REIT and direct/property are:

At the micro-level, differences are possible in:

Cash flow expectations and estimation of cost of capital. However, such differences tend to be small and short-lived, and averaged out in the long run;

Risk in the asset, not in the investor;

Relevant OCC for evaluating a given property which reflects the risk of that property.

REIT has more liquidity.

At the macro level, valuation difference exists *with* REIT because share prices reflect their:

REIT price over NAV varies over time;

REIT share price reflects existing in-place asset and entity-level capital structure;

REIT price also reflects the future growth opportunities and ability to make positive NPV with acquisitions, development and dispositions.

- (b) Explain the challenges related to behavioral finance in real estate investment when compared to equity market investment.

Commentary on Question:

The candidates performed below average on this section. Many candidates received partial credit from only providing a list of challenges without then also providing a reasonable explanation and for explaining the irrational emotion associated with physical assets. The candidates that performed well were able to explain the misunderstanding of the investor's perception of the contribution magnitude of capital gain and income in the investment return.

The misunderstanding by investors of investment in real estate for capital gain despite the fact that income drives majority of the returns.

Since real estate is a real, physical real asset and a valuable physical asset this can inspire irrational emotions.

- (c)

(i) Explain how each bias affects real estate investing.

(ii) Describe workarounds for each bias.

Commentary on Question:

The candidates performed above average on part (i) of this section. Most candidates received credit for providing relevant explanation for home bias

and framing bias. Successful candidates received credit by mentioning the influence of trendsetters associated with herding bias.

The candidates performed as expected on part (ii) of this section.

Most candidates received credit for giving consideration to the underlying drives as tenant risk and leasing risk associated with the framing bias. Successful candidates considered the level and sustainability of assets' rental income in a portfolio of investments.

Most candidates received credit for describing the need for geographical diversification in regards to home bias.

Most candidates received credit for mentioning the urge to follow the trend in regards to herding bias. Successful candidates received credit for recognizing the focus on the long-term view of the real estate investment.

(i) Bias

Framing bias

- The way we explain the choices are structured such they can influence the decision-making process. The real estate properties are usually categorized accordingly to the industry sector or geographic descriptions which are not necessarily the greater influence.
- Property-specific factors as tenant risk and lease structure often wield far greater influence on real estate than regional or sector trends.

Home bias

- Within real estate the tendency to allocate a significant proportion of the portfolios to home country investment is evident across all asset classes.
- This bias is encouraged by familiarity but also discouraged due to perceptions of higher illiquidity, higher transaction cost and greater information asymmetry.

Herding bias

- The urge to conform to established patterns or follow the lead of perceived authority figures or trendsetters.

- The strong urge to follow the crowd lures many real estate investors into chasing the market, buying high at the 'bubble' and selling low at the 'bust'.

(ii) Workaround

Framing

- Investors should place particular emphasis on the level and sustainability of assets' rental income.
- Also diversify a portfolio primarily on the basis of tenant risk and lease structure.
- Then give greater consideration to the underlying drives of real estate performance and not only on geographic location.

Home Bias

- Ensure that portfolios are diversified across geographies.
- Diversify income streams to ensure the sustainability of cash flow.
- Look abroad for more attractive valuations, take advantage of the difference in the investment cycle among different regions.

Herding

- Resist the urge to act impulsively in a downturn market.
- Take a long-term view of real estate investment.
- Consider a contrarian approach since the real estate market tends to overreact, be prepared and save your resources to buy low. (Keep dry powder to buy low).
- Avoid the impulsion to chase market trends.

(d) Your colleague made the following statements:

Statement A: "REIT A has an average cost of capital of 10%, REIT B has an average cost of capital of 12%. This implies REIT A can afford to pay more for property X than REIT B."

Statement B: "Income contributes the bulk of the total returns on real estate investment, as well as most of the volatility."

Critique your colleague's statements.

Commentary on Question:

The candidates performed as expected in regards to statement A. Most candidates correctly justified the price of the property on the basis of the property risk and not the REIT's cost of capital. Successful candidates distinguished the REIT's cost of capital from the risk at the property level.

The candidates performed above average in regards to statement B. Most candidates received credit for justifying the income as the main component of the return. Candidates that were able to explain the main contribution of capital gain to the volatility of return received full credit.

For statement A

While the risk resides with the property and shall be mostly defined by the characteristic of the property.

REIT's historical cost of capital at the firm level does not imply that it can afford to pay more for the property X since REIT's COC reflects the average risk in its current firm level assets.

This implies REIT A cannot afford to pay more for property X than REIT B.

For statement B

It is true that income contributes to the bulk of total return on the real estate and tends to be relatively stable but it is not true on its contribution to the volatility of the return.

On the contrary, the capital gains contribute to the majority of the volatility of real estate return.

26. QFI PM Spring 2023, Question 8

Learning Outcome(s): 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

Commentary on Question:

This question tests a candidate's knowledge and understanding in investment portfolio performance attribution, specifically on the capability in applying performance measurement methodologies to asset portfolios, and in assessing and interpreting performance attribution metrics for a given portfolio.

Solution:

- (a) Describe macro and micro performance attribution.

Commentary on Question:

The candidates performed below average on this section. Many candidates received credit for providing key decision variables involved in the two types of attribution. Those candidates that correctly identified the different levels at which they are conducted received full credit.

Macro attribution is conducted on the fund sponsor level, whereas micro attribution is conducted on the investment portfolio manager level. The distinction relates to the specific decision variables involved. While it is unlikely that an investment manager would be in a position to carry out macro attribution, one can easily envision situations in which a fund sponsor may wish to conduct both macro and micro attribution.

(b)

- (i) Define Normal Exposure
- (ii) Explain the differences between normal exposure and portfolio exposure in the chart above.

Commentary on Question:

The candidates performed poorly on this section. While some candidates made conceptual reference to a “benchmark portfolio” in describing the normal exposure, very few candidates correctly linked it to the normal portfolio or the manager’s historical performance.

A normal portfolio refers to a portfolio with exposures to sources of systematic risk that are typical for an investment manager, using the manager’s past portfolios as a guide. Normal exposure is a normal portfolio’s exposure to sources of systematic risk, where portfolio exposure is the portfolio’s actual exposure to sources of systematic risk.

- (c) Calculate the attribution of the active impact into market timing, fundamental risk factors, and economic sectors.

Commentary on Question:

The candidates performed below average on this section. Some candidates, of those that provided an answer, received full credit for their answers.

Total active exposure = -1.7546%. Attribution is as given below:

(%)	Portfolio Exposure (a)	Normal Exposure (b)	Factor Return (Beta)	Active Exposure (c) = (a) – (b)	Active Impact =(c)*Beta
Market					
Normal Portfolio					
Cash Timing	2.05	0.05	-0.05	2.00	-0.1
Beta Timing	1.04	1.00	2.00	0.04	0.08
-- Total Market Timing					-0.02
Growth	1.23	0.51	-0.55	0.72	-0.396
Size	-0.50	0.86	0.57	-1.36	-0.7752
Yield	-0.90	-0.54	2.44	-0.36	-0.8784
-- Total Fundamental Risk Factors					-2.0496
Basic Industry	35.23	41.00	-0.04	-5.77	0.2308
Financials	40.12	37.00	0.01	3.12	0.0312
Consumer	24.65	22.00	0.02	2.65	0.053
-- Total Economic Sectors					0.315

- (d) Calculate the portfolio return predicted by this model.

Commentary on Question:

The candidates performed poorly on this section. A few candidates, of those that provided an answer, received full credit for their answer.

Predicted return = normal portfolio return + active impact = 3.1954%

27. QFI PM Spring 2023, Question 11

Learning Outcome(s): 2d, 1b

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6; Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014 Ch 12

Commentary on Question:

This question tests the candidate's knowledge of the use of corner portfolios in asset allocation and of asset allocation considerations for endowments, insurance companies, and banks.

Overall, candidates performed below average on this question. Many candidates did not provide comprehensive explanations, and, thus, only earned partial credit on each part. Most candidates did not demonstrate an understanding of the risk tolerance of an endowment fund.

Solution:

- (a) Recommend a strategic asset allocation (asset class weights) for the CDF Fund that satisfies the return requirements and risk objectives.

Commentary on Question:

Candidates performed as expected. While many candidates were able to correctly recommend allocations to portfolios 4 and 5, some did not provide numerical justifications on the expected return and standard deviation of the combined portfolios. Some candidates incorrectly calculated the portfolio weights or did not recommend portfolio weights altogether.

A linear combination of the adjacent corner portfolios 4 and 5 will provide the minimum variance while satisfying the return requirement utilizing a 23.1% of portfolio 4 and 76.9% of portfolio 5.

$w \times 9\% + (1-w) \times 6.1\% = 6.77\%$, $w = 23.1\%$ to portfolio 4, $(1-w) = 76.9\%$ to portfolio 5

These portfolio weightings satisfy the return requirement of 6.77%

Based on these weightings, the portfolio standard deviation is 7.86% using the approximation or 7.56% using an exact approach considering the correlation, which is less than the 8% requirement.

Has the highest expected Sharpe ratio among the efficient portfolios that meet the return objective. Although portfolio 6 has a higher Sharpe ratio, its return is below the target return.

- (b) Explain why real estate should be included in the current portfolio.

Commentary on Question:

Candidates performed as expected. Most candidates only explained that real estate has low correlation with fixed income, providing risk diversification. Very few candidates explained that real estate contributes to risk reduction and virtually no candidates mentioned that real estate is in the medium corner portfolios.

Real estate has low correlation with the safe assets (bonds) and Asian equities, which makes it a very efficient diversifier of risk.

Having real estate in the portfolio maximizes the risk reduction objective while contributing to the minimum return requirement.

Real estate is in the medium risk corner portfolios.

- (c) Calculate the values of the parameter R_A for which the fund would prefer portfolio 4 to portfolio 3.

Commentary on Question:

Candidates performed below average. Some candidates only calculated the R_A but did not specify when the fund would prefer portfolio 4 to portfolio 3.

$$U_3 = E(R_3) - 0.50R_A\sigma_3^2 < E(R_4) - 0.50R_A\sigma_4^2 = U_4$$

$$.1020 - .5 \cdot R_A(.1572)^2 < .09 - .5 \cdot R_A(.1256)^2$$

$$(.1020 - .09) / (.5 \cdot .1572^2 - .5 \cdot .1256^2) < R_A$$

$$2.686 < R_A$$

- (d) Explain whether choosing portfolio 4 over portfolio 3 would be consistent with the expected risk aversion of an endowment fund.

Commentary on Question:

Candidates performed poorly. Most candidates were not able to identify that endowment funds have a low risk tolerance.

Portfolio 4 would be preferred over portfolio 3 at risk levels above 2.686, which would be consistent with the expected risk tolerance of an endowment fund.

Risk tolerance of an endowment fund is driven by a need to commit to set a spending limit each year. There is a high penalty for failing to hit the spending limit. Thus, the risk tolerance is fairly low as there is a high degree of certainty required to hit the targets.

Low risk aversion is characterized by a low risk level (1-2) and high risk aversion is characterized by (6-8)

28. QFI PM Fall 2023, Question 6

Learning Outcome(s): 2b

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors;

Commentary on Question:

This question tests the candidates' understanding of constraints in investment strategy and portfolio constructions for banks and endowments. ~~It also tests candidates' knowledge of ESG policies and applying ESG criteria to investment strategy.~~

Solution:

- (a) Compare the approach of Bank ORD and the endowment fund to managing three of the following:
 - (i) Liquidity risk
 - (ii) Tax concerns
 - (iii) Return objectives
 - (iv) Time horizon

Commentary on Question:

Overall, candidates performed as expected for this part of the question. Most candidates answered all 4 categories, however, they were given grading points for the 3 parts that gave them the highest score.

For liquidity risk, most candidates were able to recognize that the endowment had lower liquidity risk; however, most candidates did not recognize that liquidity poses a regulatory concern for the bank. They also did not recognize that endowments could invest in illiquid assets.

For tax concerns, most candidates recognized that endowments were tax exempt. However, very few candidates explained the implications on accounting treatment due to taxable status.

For return objectives, most candidates received a partial score, but very few performed the endowment's target return calculation correctly.

For time horizon, most candidates recognized that the endowment had a long-time horizon, but very few candidates recognized the annual draw needs for endowments.

(i) Liquidity:

Endowment - Given the perpetual nature of the endowment, there is limited need for liquidity. It must have cash to make spending distributions, to meet capital requirements and to facilitate portfolio rebalancing transactions. In general, endowments are well suited to invest in illiquid, non-marketable securities given their limited need for liquidity

Bank - A bank's liquidity position is a key management and regulatory concern. ORD's liquidity requirements are determined by net outflows of deposits, if any, as well as demand for loans. Liquidity will be more important in managing the funds.

(ii) Tax concerns:

Endowment - Taxes are not a major consideration for endowments in general. Because this endowment is a not for profit, it is exempt from taxation on investment income derived from interest, dividends, capital gains, rents and royalties.

Bank - Banks' securities portfolios are fully taxable. Realized securities losses decrease reported operating income, while securities gains increase reported operating income. This accounting treatment might create an incentive not to sell securities showing unrealized losses, providing a mechanism by which earnings can be managed.

(iii) Return objectives:

Endowment - The endowment's spending rate (including inflation and management expenses) must be lower than its expected rate of return in order to preserve purchasing power long term. Therefore, the portfolio must generate a long term return greater than spending rate (4.2%) plus

management expenses *(3%) , which is 7.2% above the US CPI to be able to meet its obligations.

Bank - ORD's return objectives for its securities portfolio are driven by the need to earn a positive return on invested capital Management of the portfolio will try to earn a positive spread over the cost of funds.

(iv) **Time horizon:**

The Endowment is a perpetual endowment, making the time horizon extremely long. However, annual draws for spending could present important short-term considerations, because endowments often use yearly market values to determine spending, and each annual withdrawal of capital has its specific time horizon. This would suggest multistage time horizons, in some cases.

Bank - ORD's time horizon for securities portfolio reflects its need to manage interest rate risk while earning a positive return on invested capital. Its liability structure typically reflects an overall shorter maturity than its loan portfolio, placing a constraint on the time horizon length for its securities portfolio.

- (b) ~~Describe two actions to incorporate ESG for any two of the principles above (four actions in total):~~

Commentary on Question:

~~Overall candidates performed as expected for this part of the question:~~

~~Most candidates received partial credit for this question. Many candidates listed the actions correctly but assigned them to the incorrect principle.~~

~~Credit was given for 2 actions for any two principles. The model solution below demonstrated a possible solution that would garner full credit. The full list of principles and related actions is located in the study note QFIP-136-19 page 6~~

~~Principle 1: We will incorporate ESG issues into investment analysis and decision-making processes.~~

~~Possible actions:~~

- ~~• Address ESG issues in investment policy statements~~
- ~~• Assess the capabilities of external investment managers to incorporate ESG issues.~~

~~Principle 4: We will promote acceptance and implementation of the principles within the investment industry.~~

~~Possible actions:~~

- ~~• Include Principles-related requirements in requests for proposals (RFPs)~~
- ~~• Revisit relationships with service providers that fail to meet ESG expectations~~

29. QFI PM Fall 2023, Question 7

Learning Outcome(s): 2e

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 9, Ch 10

Commentary on Question:

Candidates did quite poorly on the question overall, largely because the answers provided were not for the questions as asked.

Solution:

(a) — Justify a ranking, from best (1) to worst (3), for each of the two clients separately for the following asset classes:

- Nominal Bonds
- Commodities
- Materials Equity

Commentary on Question:

Candidates performed poorly on this section. The main issue was the question intended that the ranking was only on the inflation aspects of the

asset classes per the stem above the question. Most candidates however did the ranking on some other aspect.

Client 1: Identify Short term inflation

Client 2: Identify Long Term Inflation

Chart of Page 28 supports the following rankings:

~~Client 1: 1-Commodities, 2-Materials Equity, 3-Nominal Bonds~~

~~Client 2: 1 Materials Equity, 2Commodities 3-Nominal Bonds~~

Properties of each asset class that indicate understanding:

Materials Equity (Pages 5-7)

- ~~• Both Energy and Materials have been pro-cyclical in the past, but react differently to stages of the cycle. p5~~
- ~~• “Provide reasonable hedge against rising inflation, in particular when volatility is high” (Materials not quite as good as Energy) p6~~
- ~~• “cash flow generating so even with lower short term beta, longer term will provide higher returns” p7~~
- ~~• Sector linked to commodities tend to do better with structural inflation. p7~~

Commodities (Pages 19-20)

- ~~• “Important part of the CPI basket” p19~~
- ~~• “good relationship of inflation over the short term (p19)~~
- ~~• Different subsector behave differently. Energy strong (p19)~~
- ~~• “link to growth for industrial” p20~~
- ~~• “cautious about consistently provide inflation plus returns due to lack of cash flow generating properties.” p20~~

Nominal Bonds (pages 22-24)

- ~~• Corp Bond and US Treasuries tend to have similar relationship to inflation (generally negative in charts) p23~~
- ~~• Duration component has greatest effect on ability to hedge inflation. p24~~
- ~~• In absence of crises, we expect an inflation beta of near 0.~~
- ~~• Nominal bonds are susceptible to rising inflation & this is an issue for investors with a CPI plus target. p24~~

- ~~(TIPS were created to behave differently during rising inflation)~~

(b) ~~Explain how the empirical evidence of REITs compares to the theory that REITs are a good inflation hedge.~~

Commentary on Question:

Candidates performed poorly on this section. Many candidates discussed properties of REITs but provided no commentary on the empirical evidence.

Discussion of reasons why theory and evidence are not in alignment:

- ~~A lag period should theoretically exist between rents and overall property prices to adjust to change in the price level but it doesn't seem to come to fruition. P8~~
- ~~Short-term REITs more correlated with equities, longer term with property returns. (and equities have a poor relationship with inflation) p10~~

(c) ~~Assess whether REITs would be a better inflation hedge than Materials Equity.~~

Commentary on Question:

Candidates performed poorly on this section. Most candidates included very little explanation in their assessment. Partial credit was given for noting that Materials Equity would be the better inflation hedge.

Two statements for supporting an answer that REITs would not be a better inflation hedge:

- ~~Short term nature of residential leases allows prices increases be incorporated into contracts with tenants. (keeping pace with longer term inflation.) p10~~
- ~~REITs is not that directly related to direct property inflation as some rental income is not able to rise with inflation. p8~~
- ~~There are broad subsectors of REITs that have better inflation hedging characteristics analogous to there being subsectors of Equity that provide inflation hedges. P10~~
- ~~REITs hedge inflation similarly to Equity, but not necessarily better. P10~~

(d) Describe two concerns that the portfolio managers might have, in applying a dedication strategy.

Commentary on Question:

Candidates performed below average on this section. Most candidates identified only 1 area of concern.

1. Universe Considerations

- Quality of securities as default is assumed to be zero, but is not in reality
- Option such as call or prepayment options may prevent accurate measurement of cashflow
- Liquidity will demand rebalancing

2. Optimization

- Construction of the portfolio (minimizing the initial portfolio cost for cash flow matched subject to having sufficient cash to pay liability)
- Accurate pricing is important as optimization is sensitive to the prices of securities

3. Monitoring

- Need period performance measurement – how to do it Client 2 has a multiple liabilities with ties to CPI, so cashflows are not bullet payments
- For a multiple liability immunized plan can compare market values

4. Transaction Costs –

- important to consider when trying to meet the target rate for both the initial immunization and ongoing rebalancing necessary to avoid duration mismatch.

(e) Explain how an active strategy could be used for Client 1.

Commentary on Question:

Candidates performed poorly on this section. Many candidates offered complex solutions without stating what the objective was trying to accomplish.

1. As the company has a strong view of market conditions – this would lean towards moving to larger mismatches

2. Identifying what types of moves would be appropriate in this situation:
Some Examples:

- a. Overweight in less risky bonds, such as governments vs. corporates and/or increase credit ratings (More AAA vs. AA, etc)

- b. Overweight in shorter bonds
- (f) Describe three additional ways that the Enhanced Indexing strategy can enhance the portfolio return.

Commentary on Question:

Candidates performed below average on this section. A decent number of candidates mistakenly described different ways Enhanced Indexing may be implemented. Points were often lost for no description beyond a category name.

Points for any 3 of the following 5, with descriptions related to higher interest rates and defaults.

1. Lower Cost Enhancements: Tight control on trading costs and management fees. Although already low, expenses do vary widely on indexed funds. Also consider purchasing representative bonds vs. the entire index.
2. Issue Selection Enhancements: identify and select undervalued securities. (Own Credit Analysis) beat upgrades, avoid downgrades
3. Yield Curve Positioning – some places on the curve seem to be consistently over or undervalued. Overweight the undervalued areas and underweight the overvalued.
4. Sector & Quality positioning – Two forms
 - a. maintain a yield tilt toward short duration corporates
 - b. Overweight to periodic over or under weighting of sectors or qualities.
5. Call exposure positioning - With rising rates callable bonds may be more out of the money, consider increasing exposure.

30. QFI PM Fall 2023, Question 8

Learning Outcome(s): 2d, 1b

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 6; Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014 Ch 12, Ch 14

Commentary on Question:

This question tests the candidates understanding of asset allocation and the associated risks.

Solution:

- (a)
 - (i) Calculate the minimum expected return required to satisfy the risk objectives.
 - (ii) Explain how ABC's risk objectives would be impacted if ABC's risk tolerance increased.

Commentary on Question:

Candidates performed as expected on this section. For part (i), some candidates only calculated the minimum expected return for one of the risk objectives, and they only received partial points. For part (ii), many candidates simply commented that higher risk tolerance means taking more risks without explaining the implication to ABC's risk objectives, and they received no points.

- (i) $U_m = E(R_m) - 0.5R_A\sigma_m^2$ to get $5\% = X - 0.5 \cdot 4 \cdot 0.16^2$, where X is the expected minimum return. $X = 10.12\%$ for the expected utility risk objective.

Safety-first ratio = $(E(R_m) - R_L)/\sigma_m$ to get $0.4 = (Y - 4\%)/0.16$, where Y is the expected minimum return. $Y = 10.4\%$ for the safety-first ratio objective.

10.4% is minimum return needed to meet both objectives.

- (ii) Higher risk tolerance implies a lower risk aversion scale hence a higher expected utility. It is more likely to meet the first criteria. It has no impact on safety-first ratio.
- (b) Explain how real estate meets two of the criteria of being categorized as a separate asset class.

Commentary on Question:

Candidates performed as expected on this section. Most candidates identified and explained the diversification criteria properly. Only identifying the criteria without any explanation received no points. Candidates only needed to properly explain two criteria in order to receive full points.

- (1) Assets within an asset class should be relatively homogeneous. Real estate and equities/bonds are not homogeneous because they do not have similar attributes.
 - (2) Asset classes should be mutually exclusive. Real estate and the other assets are exclusive in that there are different markets for each one.
 - (3) Asset classes should be diversifying. Real estate and equities/bonds are diversifying. Real estate has almost a 0 correlation with Equities and Bonds.
 - (4) Asset classes should have the capacity to absorb a significant fraction of the investor's portfolio without seriously affecting the portfolio's liquidity. There is more real estate than could be invested by ABC.
- (c) Explain whether P1 and P2 could potentially be corner portfolios.

Commentary on Question:

Candidates performed below average on this section. Many candidates failed to point out P1 is a linear combination of two existing corner portfolios and

hence not a corner portfolio itself. A few candidates correctly identified and explained P2 as a potential corner portfolio and received partial points.

P1 can be constructed by 25% of CP1 and 75% of CP2. It can be constructed by corner portfolios, so it is not a corner portfolio.

As the minimum-variance frontier passes through a corner portfolio, an asset weight either changes from zero to positive or from positive to zero. Bonds weight goes from 0 to positive and equities weight goes from positive to 0. P2 could potentially be a CP.

- (d) Explain why using Monte Carlo simulation in the asset allocating process would be beneficial to ABC.

Commentary on Question:

Candidates performed below average on this section. Most candidates identified that UL portfolio has inflow and outflow but fail to properly articulate other points. Other reasonable answers were given points too.

ABC's UL liabilities have cash inflow and outflow over time. Future wealth incorporates the interaction of risk and return, and terminal wealth will be path dependent. Also, UL liabilities are long term. In a multiperiod world, the portfolio will predictably be rebalanced, triggering the realization of capital gains and losses. As ABC is a taxable investor, given a specific rebalancing rule, different strategic asset allocations will result in different patterns of tax payments (and different transaction costs too). These can be easily incorporated in a Monte Carlo simulation. Other reasonable answers were given points.

31. QFI PM Fall 2023, Question 10

Learning Outcome(s): 2d, 2e, 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021, Ch 6, Ch 9, Ch 10

Commentary on Question:

This question tests the candidate's understanding of duration and contingent immunization techniques and practical considerations for optimization of portfolios that support liabilities.

Solution:

- (a) Your manager asks you to consider the following statements with respect to ALM strategy for your company:
 - (i) If ABC wishes to take high levels of risk, the efficient frontier may provide useful insights into portfolios that optimize surplus risk
 - (ii) The duration of an asset cannot exceed its time to maturity
 - (iii) Modified Duration can be used to compare the relative sensitivity of two bonds to parallel changes in the yield curve

Critique each of your manager's statements.

Commentary on Question:

The candidates performed below average on this section. For (i), candidates did not recognize that high-risk portfolios on the surplus efficient frontier are driven by the risk-return tradeoff of assets only. For (ii), candidates that recognized asset duration could exceed maturity referenced inverse floaters or derivative instruments with leveraged cashflows as counterexamples. Partial credit was awarded to candidates who recognized this statement as true for plain-vanilla fixed-coupon or zero-coupon bonds. For (iii), most

candidates failed to recognize that modified duration is relative to the asset's yield-to-maturity. Partial credit was awarded for candidates that noted this was true for fixed- or zero-coupon bonds where small changes in the yield curve approximated the change in yield-to-maturity.

- (i) This is true. At high levels of risk, the asset allocations on the surplus often resemble high-risk asset-only efficient portfolios.
 - (ii) This is false. This relation does not hold for inverse floaters, which exhibit leveraged behavior.
 - (iii) This is false. Strictly speaking, the modified duration of a bond traditionally is calculated as the price sensitivity with respect to a change in yield-to-maturity. However, the yield to maturity is bond-specific and depends on the coupon rate, which may differ between bonds. Furthermore, the yield-to-maturity may not be well-defined for bonds that have floating coupon rates or embedded options.
- (b) Calculate the initial dollar duration of the liability.

Commentary on Question:

The candidates performed below average on this section. Many candidates incorrectly scaled the duration by the cashflow instead of the market value.

Since the liability consists of a single, fixed cashflow at time 10 its duration is 10.

$$\text{Dollar Duration} = \text{Duration} \times \text{Market Value}$$

$$\text{Market Value of Liability} = \$100M \times e^{-3.50\% \times 10} = \$70.46881M$$

$$\text{Dollar Duration} = 10 \times 70.46881M = \$704.68809M$$

- (c) Calculate the initial dollar safety margin.

Commentary on Question:

The candidates performed as expected on this section.

The initial dollar safety margin is the excess premiums over the market value of the liability.

$$\text{Initial Dollar Safety Margin} = \$74M - \$70.46881M = \$3.53119M$$

- (d) Calculate the initial investment in each of Bond A and Bond B that will dollar duration-match the liability.

Commentary on Question:

The candidates performed as expected on this section. Many were able to identify the key conditions that needed to be satisfied to dollar-duration match the liability. Candidates that presented a method that was not tractable received little credit.

By dollar-duration matching, we have

$$DD_A + DD_B = \$704.68809M$$

Because A and B are zero-coupon bonds, their durations are their times to maturity:

$$DD_A = 5A$$

$$DD_B = 30B$$

Putting the above together we have

$$5A + 30B = \$704.68809M \quad (1)$$

Since the premium is used to purchase the bonds, we also know

$$A + B = \$74M,$$

or, equivalently:

$$B = \$74M - A \quad (2)$$

Substituting (2) into (1):

$$5A + 30(\$74M - A) = \$704.68809M$$

Solving for A we get:

$$A = \frac{30 \times \$74M - \$704.68809M}{30 - 5} = \$60.61248M$$

And

$$B = \$74M - \$60.61248M = \$13.38752M$$

We verify the dollar-duration matching:

$$DD_A + DD_B = 5 \times \$60.61248M + 30 \times \$13.38752M = \$704.68809M$$

- (e) Calculate the new positions in each bond that will restore the dollar duration-matching.

Commentary on Question:

The candidates performed below average on this section with few achieving full credit. Most failed to recognize that both asset and liability market values had changed. A common error was to assume that the asset values were rebalanced to the initial premium rather than the asset values under the new yield curve.

We use our formulas from above to recalculate the market value and dollar duration of the liability:

$$\text{Market Value} = \$100M \times e^{-3.10\% \times 10} = \$73.34470M$$

$$\text{Dollar Duration} = 10 \times \$73.34470M = \$733.44696M$$

We also need to revalue the liabilities for the change in yield curve:

$$A = \$60.61248M \times \frac{e^{-2.75\% \times 5}}{e^{-3.25\% \times 5}} = \$62.14689M$$

Since the 30-year yields remained unchanged, the value of B does not change, $B = \$13.38572M$.

To rebalance the assets so that they dollar-duration match the liabilities, we need

$$DD_A + DD_B = \$733.44696M,$$

subject to the constraint:

$$A + B = \$62.14689M + \$13.38572M = \$75.53441M$$

Solving:

$$A = \frac{30 \times \$75.53441M - \$733.44696M}{30 - 5} = \$61.30342M$$

$$B = \$75.53441M - \$61.30342M = \$14.23100M$$

We verify the dollar-duration matching:

$$DD_A + DD_B = 5 \times \$61.30342M + 30 \times \$14.23100M = \$733.44696M$$

- (f) Calculate the new dollar safety margin.

Commentary on Question:

The candidates performed below average on this section. Many candidates did not use the market value of the asset they had previously calculated in part (e).

The dollar safety margin has reduced to:

$$\$75.52441M - \$73.34470M = \$2.18972M$$

- (g) Approximate the further decrease in 10-year rates that would require immediate immunization of the portfolio (no change to the 5-year and 30-year rates).

Commentary on Question:

The candidates performed below average on this section. A variety of reasonable approximations were used by candidates. Many left this section blank.

A shift in the 10-year rates will change the liability market value; if it reaches the asset market value the dollar safety margin will be reduced to \$0, triggering immediate immunization. We solve:

$$\$75.53441M = \$100M \times e^{-r \times 10} \rightarrow r = -\frac{1}{10} \ln \left(\frac{\$75.53441M}{\$100M} \right) = 2.80582\%$$

This implies a rate decrease of

$$3.10\% - 2.80582\% = 0.29855\%$$

will trigger immediate immunization.

- (h) Describe the advantages of adding Monte Carlo simulation to your ALM program.

Commentary on Question:

The candidates performed as expected on this section. Most candidates were able to earn partial credit with a few earning full credit. The ability of Monte Carlo simulation to provide information on the risk distribution was commonly cited.

Surplus optimization (e.g. mean-variance optimization) is essentially a one-period model. Advantages of Monte Carlo simulation over surplus optimization include:

- Monte Carlo simulation is a multi-period model, making it particularly useful for investors with long time horizons
- Can help confirm that recommended allocations provide sufficient diversification
- Can help evaluate the probability of funding shortfalls (requiring contributions)
- Can help evaluate the probability of breaching thresholds
- Can help evaluate the growth of assets with and without disbursements from the portfolio

32. QFI PM Fall 2023, Question 13

Learning Outcome(s): 2i, 2J, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

Commentary on Question:

This question tests creating benchmarks and measuring performance against them. Candidates are also tested on the flaws of certain benchmarks.

Solution:

- (a) List four properties of a valid benchmark for performance evaluation.

Commentary on Question:

The candidates performed brilliantly on this section. Most candidates named at least one property of a valid benchmark. Candidates who did not provide four were given partial credit.

The properties of a valid benchmark are:

- Unambiguous: The identities and weights of securities or factor exposures constituting the benchmark are clearly defined.

- Investable: It is possible to forgo active management and simply hold the benchmark.
- Measurable: The benchmark's return is readily calculable on a reasonably frequent basis.
- Appropriate: The benchmark is consistent with the manager's investment style or area of expertise.
- Reflective of current investment opinions: The manager has current investment knowledge of the securities or factor exposures within the benchmark.
- Specified in advance: The benchmark is specified prior to the start of an evaluation period and known to all interested parties.
- Owned: The investment manager should be aware of and accept accountability for the constituents and performance of the benchmark.

(b) Describe how to construct a custom security-based benchmark.

Commentary on Question:

The candidates performed as expected on this section. Most candidates described at least one part of the process. Common issues included missing the final review and rebalance steps.

Development of a custom benchmark involves the following:

- Analyze the manager's past portfolios to identify prominent aspects of the manager's investment process.
- Select benchmark portfolio securities using screening criteria consistent with the manager's investment process.
- Devise a weighting scheme for the benchmark securities, including a cash position, using the manager's investment process and client restrictions.
- Review the preliminary benchmark and make modifications.
- Rebalance the benchmark portfolio on a predetermined schedule to keep the benchmark portfolio current with the manager's investment process.

(c) Assess the portfolio performance using the following attribution breakdowns:

- (i) Pure selection allocation
- (ii) Allocation/selection interaction

(iii) Within-sector selection

(iv) Total value added

Commentary on Question:

The candidates performed as expected on this section. Most candidates were able to provide the correct calculations but lost points for not explaining what the results meant. Some candidates also switched items ii and iii.

(i) Pure sector allocation = Sum of [(Portfolio weight - Benchmark weight) x (Benchmark sector return - Total benchmark return)]

	Weight	Return
Basic Materials	-20%	-0.80%
Energy	20%	1.20%
Attribution		0.40%

Positive effects from active overweighting (underweighting) the Energy (Basic materials) sector since it performed better (worse) than the overall benchmark.

(ii) Allocation/Selection Interaction = Sum of [(Portfolio weight - Benchmark weight) x (Portfolio sector return - Benchmark sector return)]

	Weight	Return
Basic Materials	-20%	1.00%
Energy	20%	0.00%
Attribution		-0.20%

Negative effects from active underweighting the Basic materials sector due to the portfolio's positive performance in the Basic Materials sector relative to the benchmark's Basic Materials sector performance.

(iii) Within-Sector Selection = Sum of [Benchmark weight x (Portfolio sector return - Benchmark sector return)]

	Weight	Return
Basic Materials	60%	1.00%
Energy	40%	0.00%
Attribution		0.60%

Positive effects from active security selection decisions within sectors.

iv) Total value Added = 0.80% = Sum of (Portfolio weights x Portfolio returns) - Total benchmark return OR = Pure sector allocation + Allocation/selection interaction + Within-sector selection

Overall positive effects from the active management of the portfolio.

(d) Calculate the following performance metrics for this portfolio:

(i) Jensen's alpha

(ii) Treynor ratio

Commentary on Question:

The candidates performed as expected on this section. Most candidates calculated the values correctly. Some candidates did not include the risk-free rate in the calculation for Jensen's alpha.

(i) Jensen's Alpha = (portfolio return – Current risk-free rate) – Beta x (Current market index return – Current risk-free rate) = $(0.11 - 0.02) - 0.5 \times (0.10 - 0.02) = 0.05$

(ii) Treynor Measure = (Average portfolio return – Average risk-free rate) / Beta = $(0.11 - 0.02) / 0.5 = 0.18$

(e) You are considering the following performance evaluation options:

- Compare the manager's performance against the median manager return from a database of other account returns in similar institutions.
- Calculate a risk-adjusted performance metric to compare the manager's performance against the market using the CAPM model.

Assess these two performance evaluation options.

Commentary on Question:

The candidates performed as expected on this section. Most candidates were able to describe the issue of the median manager metric. However, many candidates did not fully explain the flaws of the CAPM metric.

Possible critiques of the median manager metric:

- The median account cannot be specified in advance. The manager nor the fund sponsor has any knowledge of who the median manager will be.
- The benchmark is not investable and cannot serve as a passive alternative to holding the account that is under analysis. The identity of the median manager typically remains unknown, so the account cannot be replicated.

- The ambiguity of the median manager account makes it impossible to verify its appropriateness by examining whether the investment style it represents adequately corresponds to the account being evaluated.
- Because fund sponsors terminate underperforming managers, performance data are subject to survivor bias.
- The only advantage is that performance is measurable.

Possible critiques the risk-adjusted metric:

- Metric depends on the validity of the CAPM, such as its assumptions and single index nature.
- The metric relies on a surrogate for the true market portfolio (such as the S&P 500).
- If assets are valued according to other equilibrium pricing models, CAPM may be inaccurate.
- It is difficult to replicate the market index due to transaction costs and reinvestment costs. Therefore, the index overstates possible returns.
- Issues with parameter stability and estimation errors

33. QFI PM Spring 2024, Question 2

Learning Outcome(s): 2g

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 12

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:

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

- Value-weighted method
- 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.

Value-weighted return:

$(\text{Sum of 12/31/2025 MV} / \text{Sum of 12/31/2024 MV}) - 1 = 30.29\%$

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

- (b) 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.

(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.

34. QFI PM Spring 2024, Question 6

Learning Outcome(s): 2c, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 19

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.

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.

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

$$= (0.4^2 + (0.0^2 + 0.4^2) / (1 + (-0.2)))^{(1/2)} = 0.6$$

- (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))

$$\text{Weight A} = .15 / (.4 * (1 - (-.2)^2)) * ((0/.04) - (-.2) * .4/.025)) = 1.25$$

$$\text{Weight B} = .15 / (.4 * (1 - (-.2)^2)) * ((.4/.025) - (-.2) * .0/.04)) = 6.25$$

$$\text{Weight Market portfolio} = 1 - 1.25 - 6.25 = -6.5$$

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

$$\text{Market return portfolio A} = \text{market return over risk free} + \text{portfolio A return over market} = 0.06 + 0.0 = .06$$

$$\text{Market return portfolio B} = \text{market return over risk free} + \text{portfolio B return over market} = 0.06 + 0.01 = .07$$

$$\text{Total excess return of maximum possible factor Sharpe Ratio portfolio} = 6.5 * .06 + 1.5 * .06 + 6.5 * .07 = 12.25\%$$

35. QFI PM Spring 2024, Question 7

Learning Outcome(s): 2g

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2003 Ch 12

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 assessed 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.

(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.

(i) — Determine Information ratio for Fund C (Use formula 7-1);

$$IR \approx IC / \text{Breadth}$$

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.

$$IR_C = 0.05 / 100 = .5$$

$$IR_A = 0.03 / X = .5$$

$$X = 278$$

(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.
- **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.

36. QFI PM Spring 2024, Question 8

Learning Outcome(s): 2b, 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19; INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute

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

(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.

(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.

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.

37. QFI PM Spring 2024, Question 14

Learning Outcome(s): 2b, 2c, 2d

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 6; INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute

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 MGC 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.

- (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%			

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%

(c)

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

(ii) (1 point) Describe two actions MGC 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

38. QFI PM Fall 2024, Question 4

Learning Outcome(s): 2d, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6, Ch 19

Solution:

- (a) List three considerations in which Monte Carlo simulation methods can help to confirm the quality of mean-variance or surplus optimization recommended allocations.

Commentary on Question:

Candidates performed below average on this section. Candidates demonstrated broad understanding of Monte Carlo principles in analyzing probabilities for portfolio outcomes. Few candidates were able to explicitly reference the detailed listing of considerations provided in the source. Full credit was given if 3 out of the 4 points were listed.

- MVO and surplus optimization is typically confined to a single period.
- Monte Carlo simulation is useful in defining the probability of funding shortfalls.
- Monte Carlo simulation is useful in defining the likelihood of breaching return thresholds.
- Monte Carlo simulation is useful in evaluating portfolio growth with or without distributions.

- (b) You are assisting in this simulation exercise and have elected to apply a three-step asset-liability management method as defined by Sharpe. The objective function is:

$$U_m^{ALM} = E(SR_m) - 0.5R_A\sigma^2(SR_m)$$

Describe each expression within the above objective function.

Commentary on Question:

Candidates performed above average on this section. Candidates were successful in describing each quantity in the equation in sufficient detail. Points were deducted for not fully defining each component that drives a given quantity, or describing the “m” subscript as referencing the market rather than the asset mix.

- U_m^{ALM} is the surplus objective function’s expected value for a particular asset mix m, for a particular asset investor with the specified risk aversion.
- $E(SR_m)$ is the expected surplus return for asset mix m, with surplus return defined as (Change in asset value – Change in liability value)/(Initial asset value).
- $\sigma^2(SR_m)$ is the variance of the surplus return for the asset mix m.
- R_A is the investor risk aversion level.

(c)

- (i) Calculate the increase in expected surplus return required for Insurer XYZ to prefer Alternative Portfolio A over its current portfolio.
- (ii) Calculate the decrease in standard deviation required for Insurer XYZ to prefer Alternative Portfolio B over its current portfolio.

Commentary on Question:

Candidates performed brilliantly on this section. Almost all candidates used the given information within the objective function to determine the required change in surplus expected return or decrease in standard deviation. Some candidates did not explicitly state the required change amount.

We first determine the value from the objective function for the initial portfolio.

$$U_m^{ALM} = E(SR_m) - 0.005R_A\sigma^2(SR_m)$$

$$U_c^{ALM} = 4 - 0.005(8)(10)^2 = 0$$

Our decision criteria is based on selecting a higher U_m^{ALM} value, so Insurer XYZ will only prefer Alternative Portfolio A if the value of U_A^{ALM} is greater than 0. So, for Portfolio A, we have:

$$U_A^{ALM} = E(SR_A) - 0.005(8)(14)^2 > 0, E(SR_A) > 7.84$$

This indicates that the needed increase in surplus expected return is $7.84 - 4 = 3.84\%$ for A.

In order to prefer Alternative Portfolio B, we again need to have a value of U_B^{ALM} that is greater than 0. Thus our calculation is

$$U_B^{ALM} = 2 - 0.005(8)\sigma^2(SR_B) > 0, \sigma(SR_B) < 7.07$$

This indicates that the needed decrease in standard deviation is $7.07 - 10 = -2.93\%$ for B.

(d)

- (i) Recommend statistical measures by which to judge the projected performance of the portfolio with respect to the funded ratio.
- (ii) Propose a criterion that Insurer XYZ could utilize in determining the appropriateness of the portfolio.

Commentary on Question:

Candidates performed below average on this section. Most candidates were able to recall appropriate statistical measures. Partial credit was given for reasonable suggestions for criteria. Candidates performed worse in part (ii). Most candidates were unable to state clear criterion that would determine a portfolio's success.

- i. Appropriate example measures may include the mean, median, or tail risk level suggested by the distribution of the projections.
- ii. An example criterion should address a short or long-term time frame by which to judge the projected performance, such as:
 - Median funded ratio after 20 years equals at least 100 percent.
 - No more than a 10 percent probability of a funded ratio less than 90 percent in any one year.

39. QFI PM Fall 2024, Question 5

Learning Outcome(s): 2g, 2h, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 12, Ch 13, Ch 19; INV101-104-25: The Hidden Dangers of Passive Investing

Commentary on Question:

This question tests the different approaches and measurement of equity investment, in the context of mutual funds vs. ETFs, passive, semi-active vs. active investment approach, as well as the concept of attribution analysis of risk and return.

Solution:

- (a) Describe the economically significant differences between conventional index mutual funds and ETF's.

Commentary on Question:

Most candidates performed below average on this section. A few candidates correctly mentioned the transaction costs including commissions to trade ETFs. However, most candidates did not state the shareholder accounting expense of mutual funds, as well as the higher index license fees and tax efficiency for ETFs in many markets.

Shareholder accounting at the fund level can be a significant expense for conventional mutual funds in some markets, but ETFs do not have fund level shareholder accounting.

Exchange-traded funds generally pay much higher index license fees than conventional funds.

Exchange-traded funds are often much more tax-efficient than conventional funds in many markets, including the United States.

Users of exchange-traded funds pay transaction costs including commissions to trade them, but for their ongoing shareholders, ETFs provide inherently better protection from the cost of providing liquidity to shareholders who are selling fund shares.

- (b) ABC Life has been maintaining a passive investment approach in its equity portfolio.

Explain the hidden danger in ABC's approach.

Commentary on Question:

Most candidates performed below average on this section (b). Most candidates correctly mentioned the over-valuation and blind allocation to all stock. However, most candidates did not state the suffering of market efficiency and the lack of differentiating stock winners from losers.

When too many investors rely on passive strategies, market efficiency suffers and opportunities for active managers emerge.

Passive Strategies Are Blind to Relative Value. When an index fund or ETF

receives inflows, the fund essentially has no choice but to invest in stocks based on their index allocation at that moment, without any consideration of fundamentals, valuation, or anything else.

Broad over-valuation is an unintended consequence of large, uninterrupted inflows into ETFs and other passive index products.

Instead of blindly allocating to all stocks through a passive strategy, those looking to generate above market returns should be more selective in their investing process.

When an investment process makes no effort to differentiate winners from losers, and instead blindly allocates based on index weights, there is no diligence, no intelligent capital allocation, and eventually, no efficient market.

- (c) A year later, ABC's equity portfolio began to explore semi-active equity management. It evaluated 3 investment managers using Grinold and Kahn's Fundamental Law of Active Management, considering the Information Coefficient (IC) and Breadth to compute the Information Ratio (IR).

Manager A follows 200 stocks with annual forecasts; IC of each forecast is 0.03.

Manager B follows 100 stocks with annual forecasts, IC for each forecast is 0.04.

Manager C follows 300 stocks, with 200 independent forecasts (IC is 0.02 for each), while the remaining 100 are dependent forecast (IC is 0.03 for each).

Assess which manager gives the highest IR.

Commentary on Question:

Most candidates performed above average on this part (c). Most candidates correctly calculated the IC for Manager A and B. However, a small number of candidates overlooked the dependent forecast (100 of the stocks) for Manager C, in which dependent stocks' IC should contribute nothing to the Manager's IC.

- (d) Describe possible limitations of the semi-active stock selection approach.

Commentary on Question:

Most candidates performed below average on this section (d). Most candidates correctly mentioned techniques that generate positive alpha may become obsolete over time. However, most candidates did not mention the other points noted below.

The first is that any technique (Factor or Smart-beta) that generates positive alpha may become obsolete as other investors try to exploit it.

A successful enhanced indexer is always innovating.

Also, quantitative and mathematical models derived from analysis of historical returns and prices may be invalid in the future.

Markets undergo secular changes, lessening the effectiveness of the past as a guide to the future.

Markets also occasionally undergo shocks that, at least temporarily, render forecasting or risk models ineffective.

(e)

(i) Total active risk of Manager X

(ii) IR of Manager X

Commentary on Question:

Most candidates performed above average on this section (3). Most candidates correctly calculated the active risk and active return. However, a few candidates did not use the formula of IR correctly, which is the ratio True Active Return / True Active Risk.

(e) (i) Active Risk

$$\text{Active Risk} = \text{SQRT}(\text{True Active Risk}^2 + \text{Misfit Risk}^2)$$

$$\text{Active Risk} = \text{SQRT}(0.05^2 + 0.04^2)$$

$$\text{Active Risk} = \text{SQRT}(0.0025 + 0.0016)$$

$$\text{Active Risk} = \text{SQRT}(0.0041) = 0.064031242..$$

So the Total Active Risk of Manager X is 6.403%

(ii) Information Ratio (IR)

The Information Ratio (IR) measures a portfolio manager's true risk-adjusted return by dividing the portfolio's true active return (portfolio return minus benchmark return) by the active risk.

Since Manager X is a value-oriented manager, the S&P 500 Value Index (14%) is a better benchmark than the S&P 500 Index (10%).

$$\text{True Active Return} = \text{Portfolio Return} - \text{S\&P 500 Value Benchmark Return}$$

$$\text{True Active Return} = 15\% - 14\% = 1\%$$

Now, we can calculate the true Information Ratio (IR) of Manager X:

$$\text{IR} = \text{True Active Return} / \text{True Active Risk}$$

$$\text{IR} = 1\% / 6.403\%$$

$$\text{IR} = 0.156 = 15.6\%$$

- (f) Explain how the distinction between “true” and “misfit” can be used in portfolio construction optimization.

Commentary on Question:

Most candidates performed poorly on this section (f). Most candidates stated the definitions of “true” and “misfit” risk and return without explaining the connection between the two in the context of portfolio construction optimization.

By disaggregating each of the active risk and return into two components, it is possible to create optimal solutions that maximize total active return at every level of total active risk, and that also for the optimal level of “misfit” risk.

Although it may seem that no “misfit” risk is desired, a nonzero amount of “misfit” risk may actually be optimal, because a high level of “true” active return may more than compensate for a given level of “misfit” risk.

40. QFI PM Fall 2024, Question 7

Learning Outcome(s): 2a, 2b, 2c

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5; INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute

Commentary on Question:

This question tests the candidates' knowledge of investment policy creation for a life insurance company.

Solution:

- (a) Describe the four planning steps that ORD should go through as part of the portfolio management process.

Commentary on Question:

Candidates performed as expected for this part of the question.

Most candidates were able to identify each of the four steps; however, most were not able to describe the steps in adequate detail.

Identify and specify MDW's return and risk objective and constraints: As a life insurer returns should be to meet liabilities, and minimize volatility of surplus of assets relative to liabilities and use ALM strategies to protect surplus from changes in interest rates. Insurance constraints are time horizon which is usually long, liquidity concerns and taxes.

Creation of the Investment policy statement which documents investment strategy, rules for reallocation, roles of parties defined, rebalancing guidelines, and a brief client description.

Form capital market expectations: Long run forecasts of risk and return to determine asset classes available for investment.

Form the strategic asset allocation based on knowledge of capital market expectation, investor objectives and constraints to determine target asset class weights

- (b) Describe active, semi-active, and passive investment strategies.

Commentary on Question:

Candidates performed as expected for this part of the question.

Most candidates were able to distinguish the main differences among active, passive and semi-passive investment strategies.

However, most candidates failed to mention alpha and/or describe how it works as part of the active approach.

Also, most candidates mentioned indexing as passive investment strategies, but did not explain how it works in sufficient detail.

Active investment strategies are ones that include decisions on securities based on capital market behavior expectation, go beyond the benchmark, creating more alpha, which is value added return

Passive is managing portfolio against an index. Indexing is most common form, another form is buy and hold strategy.

Semiactive allows for reacting to capital market changes, but tries to limit risk. Tracks against benchmark and tries to add alpha while keeping tracking risk to a minimum

- (c) Describe a situation where the portfolio's actual asset allocation differs from the strategic asset allocation.

Commentary on Question:

Candidates performed above average for this part of the question.

Most candidates were able to identify tactical asset allocation and provide a reasonable description of how that works. Candidates who didn't earn full credit tended to identify a situation but did not fully describe it.

A situation where the portfolio's actual asset allocation can vary from its SAA is when a TAA (Tactical Asset Allocation) is used to take advantage of short term fluctuations in the capital market expectations.

- (d) Explain how the merger impacts ORD's IPS.

Commentary on Question:

Candidates performed as expected for this part of the question.

Most candidates were able to identify at least one of the changes that happened and explained how that could impact the company's IPS. Candidates who earned less than full credit did not fully describe the impacts in terms of the annuity risk and profile, or the investor circumstances.

The IPS will have to be revisited since the risk objective and constraints of a merged company might be different since investor circumstances have changed. Annuities have a different risk and liquidity needs profile than life and disability products. That also calls for a review and update of the PI.

- (e) Five years later ORD conducts an assessment of its investment performance.

Identify two components that are part of this assessment.

Commentary on Question:

Candidates performed as expected for this part of the question.

Most candidates were able to identify at least one of the three components that are part of investment performance assessment. A good number of candidates were able to identify two.

The components of assessing investment performance are performance measurement performance appraisal and performance attribution.

41. QFI PM Fall 2024, Question 8

Learning Outcome(s): 2i, 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

Commentary on Question:

This question tests performance valuation and benchmark selection.

Solution:

- (a) Describe three additional steps in designing this new investment portfolio.

Commentary on Question:

The candidates performed as expected on this section. Most were able to describe additional steps to portfolio design. Many candidates did not receive credit for describing steps to select asset classes even though the problem had indicated that asset classes were already chosen.

Design of a portfolio involves at least three additional steps:

- Decide upon the normal, or long-term, weights for each of the asset classes allowed in the portfolio
- Strategically altering the investment mix weights away from normal in an attempt to capture excess returns from short-term fluctuations in asset class prices (market timing)
- Select individual securities within an asset class to achieve superior returns relative to that asset class (security selection).

- (b) Critique the benchmarks below in measuring portfolio performance.

(i) Investment style index

(ii) Factor model

Commentary on Question:

Candidates performed as expected in this section. Some candidates received full credit for listing both pros and cons to each benchmark. Some candidates received partial credit for only listing cons.

Investment style index

Pros

- Well known
- Easy to understand: Benchmark corresponds to the manager's investment style
- Widely available: Common style indices already exist for reference

Cons

- Some style indexes contain weightings in certain securities and economic sectors that are much larger than what many managers consider prudent.
- The definition of investment style implied in the benchmark may be ambiguous or inconsistent with the investment process of the manager being evaluated.
- Differing definitions of investment style at times can produce rather extreme return differentials.

Factor model

Pros

- Captures the systematic sources of return that affect an account's performance
- Helps managers and fund sponsors better understand a manager's investment style

Cons

- Not always intuitive to the fund sponsor and particularly to the investment managers
- Ambiguous. We can build multiple benchmarks with the same factor exposures, but each can earn different returns.
- The composition of a factor-based benchmark is not specified with respect to the constituent securities and their weights, we cannot verify all the validity criteria (the benchmark may not be investable, for example).

- (c) Calculate both the time-weighted rate of return (TWR) and the money-weighted rate of return (MWR) over the year.

Commentary on Question:

Candidates performed above average in this section. Most candidates received partial credit for correctly calculating the portfolio values and time-weighted rate. Some candidates did not annualize the rate after deriving the

quarterly return. As the problem did not specify whether cash flows occurred at the beginning or end of the quarter, answers using either assumption were accepted.

See Excel file

- (d) Explain the challenges in determining the rate of return in a long/short hedge fund.

Commentary on Question:

Candidates performed below average in this section. Many candidates received partial credit for indicating that long and short positions interfere with the account value and return calculation. A common error was describing items that were not relevant to rate of return or not explaining how their points connect to the return calculation.

In theory, the net assets of a long-short portfolio could be zero; the value of the portfolio's long positions equal the value of the portfolio's short positions. In this case, the beginning market value would be zero and the account's rate of return would be either positive infinity or negative infinity. In the real world of long-short investing, an account will typically have a positive net asset value due to various margin and administrative requirements. However, as the net asset value gets smaller and approaches zero, the account's return will become nonsensically extreme (large positive or large negative).

- (e) Describe the difficulty in creating benchmarks for hedge funds and recommend a solution.

Commentary on Question:

Candidates performed above average in this section. Most candidates received full credit for describing an issue and proposing an appropriate solution. Some candidates did not adequately explain how their items would be an issue in benchmarking or did not provide a reasonable solution.

Difficulty in creating benchmarks for hedge funds:

A wide variety of active investment strategies fall under the category of hedge funds. Some hedge fund managers have very clearly definable investment universes composed of highly liquid, daily priced securities. Other hedge fund managers, such as macro hedge fund managers, take rapidly changing long-short leveraged positions in an array of asset categories ranging from equities to commodities, which present significant benchmark-building challenges. Solutions to create benchmarks:

- Construct separate long and short benchmarks, then combine in appropriate proportions to create a valid benchmark. This requires the historical returns and holdings of the manager's long and short portfolios.
- Use the Sharpe ratio or information ratio. This is a measure of excess returns over a risk-free return relative to the volatility of returns. It can be calculated without reference to the manager's underlying investment universe. Typically, a hedge fund's Sharpe ratio is compared to that of a universe of other hedge funds that have investment mandates assumed to resemble those of the hedge fund under evaluation.

42. QFI PM Fall 2024, Question 9

Learning Outcome(s): 2g

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 12

Commentary on Question:

This question tests the fundamentals of equity and alternative investments. The candidate need to demonstrate an understanding of different portfolio weightings

and their relative bias. It also tests the candidates' ability to construct a portfolio with a benchmark index.

Overall, candidates performed as expected on this question.

Solution:

- (a) Describe the following index weighting choices, including their respective biases.

(i) *Price Weighted*

(ii) *Value Weighted*

(iii) *Equal Weighted*

Commentary on Question:

The candidates performed above average on this section. Most candidates were able to identify what each index weighting choices is weighted on, and what they are biased towards, but failed to provide sufficient description on the weighting choices, hence only got partial credit.

1. Price Weighted

In a price weighted index, each stock in the index is weighted according to its absolute share price.

The index is the sum of the share prices divided by the number of shares in the index.

The price weighted index is biased towards companies with a high stock price, since the stocks with higher prices receive higher weighting regardless of market share.

2. Value Weighted

In a value weighted index, each stock is weighted according to its market capital. There may be float-weighted index, in which the market capitalization is based on outstanding shares available to investors.

A value weighted index is biased (overweighted) towards large market cap companies since they receive higher weighting.

3. Equal weighted

In an equal weighted index, each stock in the index is weighted equally.

In an equal weighted index, small companies have the same weight in the index as very large companies.

Therefore, it is biased towards smaller companies.

- (b) Explain the expected net change in your portfolio as the result of this drop.

Commentary on Question:

The candidates performed as expected on this section. Most candidates were able to conclude that the net change is a loss in the portfolio, because the drop in long position is larger than the gain in the short position. Full credit was only given to candidates who were able to discuss the impact of the 2nd largest company in each index.

- S&P 500 is a value-weighted index, where stocks are weighted according to its market capitalization. S&P 500 equal weight is an equal weighted index.
- 2nd largest is a large cap company; therefore, it is overweighted in the S&P 500. In the S&P 500 equal weighted index (S&P500 EWI), 2nd largest is weighted equally with other stocks.
- When 2nd largest drops by 10%, it has a larger impact on S&P500 than S&P 500 EWI. Therefore, S&P 500 index will drop more than S&P500 EWI.
- The portfolio has a long position in S&P500 and a short position in S&P500 EWI. Therefore, your portfolio will drop but expected to be less than 10%.

- (c) You are now asked to construct a portfolio to track the S&P 500 index utilizing full replication, stratified sampling, or optimization.

Compare these three methods.

Commentary on Question:

The candidates performed as expected on this section. Most candidates were able to describe full replication, stratified sampling and optimization and compare the tracking error or transaction costs between the 3 methods, but only a few candidates were able to comment on some of the main differences between the methods. For example, stratified sampling assumes no correlation between cells, and there is not enough diversification, etc., hence only got partial credits.

Full replication: every component in the index will be represented in the portfolio, and each portfolio position will have approximately the same weight in the fund as in the index. Full replication has the least tracking error and highest transaction cost.

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 to mimic the index. Stratified sampling implicitly assumes that there is no correlation between the stratified cells and this portfolio does not provide enough diversification since only a few stocks are included in the portfolio.

Optimization uses a subset of the indexed fund to track the risk exposure and the return of the index. Optimization potentially has the greatest tracking error since it is based on mathematical models.

Given that the S&P500 is relatively easy to replicate, optimization is not the best choice.

43. QFI PM Fall 2024, Question 12

Learning Outcome(s): 2f

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 10

Commentary on Question:

The candidates performed as expected on this question. This question tested the candidates' knowledge of using various methods to manage a portfolio to a target duration. Candidates performed best on parts (a) and (b) and had difficulty on part (d).

Solution:

- (a) Calculate the number of futures contracts your manager needs to buy or sell to meet the \$150M dollar duration target.

Commentary on Question:

The candidates performed above average on this part with many candidates receiving full points. For candidates who did not receive full points, common errors included not accounting for the existing dollar duration of the portfolio and not recognizing the need for the company to sell contracts to achieve the duration target.

$$DD_{portfolio} = 4.8 * 5 + 7.3 * 3.2 + 12.7 * 10.4 = 179.44MM$$

$$DD_{target} = DD_{portfolio} + DD_{future} * \frac{Contracts}{ConvFact}$$

$$150MM = 179.44M + \frac{100,000 * 5}{100,000 * 1.2} * Contracts$$

$$Contracts = -70.656$$

Sell 71 Futures Contracts

- (b) Calculate the amount and position in the swap needed to match the \$150M target dollar duration.

Commentary on Question:

Candidates performed above average on this part with many candidates receiving full points. For candidates who did not receive full points, the most common mistake was incorrectly calculating the duration of the swap and stating the wrong position the company needed to enter. Candidates who carried forward an incorrect dollar duration from part (a) received full points for correct calculations in part (b)

Dollar Duration of Swap (Pay fix point of view) = $DD_{floatbond} - DD_{fixedbond}$

$$DD_{swap\ pay\ fix} = 100,000 * 0.4 - 100,000 * 6.5 = -610,000$$

$$DD_{target} = DD_{portfolio} + DD_{swap\ pay\ fix} * AmountInvested$$

$$150MM = 179.44MM + \frac{-610,000 * X}{1,000,000}$$

$X = 48.26MM \text{ in fixed rate payer side of swap}$
--

- (c) Compare using futures or interest rate swaps to meet the target dollar duration.

Commentary on Question:

Candidates performed as expected on this part of the question. Most candidates were able to compare futures and swaps, but few tied their comparisons to the situation in this question. Full points were awarded to candidates who compared futures and swaps and suggested which would better for managing dollar duration. There were different areas of the syllabus candidates could pull information for this part, so candidates who stated the company should use swaps and candidates who stated the company should use futures was accepted with proper support.

Both swaps and futures can accomplish target duration management; in contrast to cash markets, both can also be used to reduce the duration of a portfolio and are generally considered to be liquid markets. However, swaps generally have lower transaction costs and are considered to be more efficient than futures.

- (d) ~~Recommend whether your manager would hedge the fund's exposure using dollar-yen forward contracts.~~

Commentary on Question:

Candidates performed below average on this section. Many candidates were unable to use the information given to calculate the unhedged vs hedged returns with few arriving at the correct answer. Candidates who stated the manager should or should not hedge using forward contracts without supporting work did not receive credit.

The interest rate differential between the dollar and yen is $4\% - 4.5\% = -0.5\%$ which is less than the manager's expected return on the yen of 0.8%. The manager should not enter a forward rate contract and lock in the -0.5% return but should let the funds' exposure to the yen remain unhedged and realize the 0.8% expected return.

44. ILA LAM Fall 2023, Question 4

Learning Outcome(s): 2a

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5

Solution:

(a)

- (i) Calculate NDV's expected utility (also referred to as "risk-adjusted return") for each asset mix.
- (ii) Calculate the safety-first ratio from Roy's safety-first criterion for each asset mix.
- (iii) Recommend an optimal asset mix. Justify your answer.

Commentary on Question:

For part (i), there is an alternative solution if candidate converts to percentages, Full credit is given for arriving at either solution.

For part (ii), full credit is given for correctly state and use the formulas for safety first ratio, identify the shortfall level based on the upcoming cash flow requirements stated in the problem, and arrive at correct calculation.

For part (iii), if candidates provided the alternative solution in (i), then asset mix W would show the highest expected utility and similar SF ratio as mix Y. Full credit is given to candidates who arrives at the alternative solution and recommends mix W with appropriate justification.

Most candidates were able to calculate utility and safety first ratio. Subsequently, most candidates were also able to identify the optimum asset allocation based on their calculations regardless if they calculated the utility/SF Ratio correctly.

(i)

$$U_m = E(R_m) - 0.005 * R_A * \sigma_m^2$$

where

U_m = the investor's expected utility for asset mix m

$E(R_m)$ = expected return for mix m

R_A = the investor's risk aversion

σ_m^2 = variance of return for mix m

Given that $R_A = 4$, then

$$U_m = E(R_m) - 0.005 * R_A * \sigma_m^2 = E(R_m) - 0.005 * 4 * \sigma_m^2 = E(R_m) - 0.02 * \sigma_m^2$$

NDV's expected utility, or risk-adjusted return for each asset mix:

$$U_W = E(R_W) - 0.02 * \sigma_W^2 = 9 - 0.02 * 19^2 = 1.8$$

$$U_X = E(R_X) - 0.02 * \sigma_X^2 = 4.5 - 0.02 * 10^2 = 2.5$$

$$U_Y = E(R_Y) - 0.02 * \sigma_Y^2 = 7.9 - 0.02 * 14^2 = 4.0$$

$$U_Z = E(R_Z) - 0.02 * \sigma_Z^2 = 6.9 - 0.02 * 12^2 = 4.0$$

(Alternative solution if candidate converts table to percentage)

NDV's expected utility, or risk-adjusted return for each asset mix:

$$U_W = E(R_W) - 0.02 * \sigma_W^2 = 9\% - 0.02 * 19\%^2 = 8.9\%$$

$$U_X = E(R_X) - 0.02 * \sigma_X^2 = 4.5\% - 0.02 * 10\%^2 = 4.5\%$$

$$U_Y = E(R_Y) - 0.02 * \sigma_Y^2 = 7.9\% - 0.02 * 14\%^2 = 7.9\%$$

$$U_Z = E(R_Z) - 0.02 * \sigma_Z^2 = 6.9\% - 0.02 * 12\%^2 = 6.9\%$$

(ii)

$$\text{Safety-first ratio} = [E(R_P) - R_L] / \sigma_P$$

Shortfall level required for safety-first ratio is $R_L = \$15M / 320M = 4.69\%$ based on stated requirement to fund upcoming liability cashflow

The safety-first ratio from Roy's safety-first criterion for each asset mix:

$$W: (9\% - 4.69\%) / 19\% = 22.7\%$$

$$X: (4.5\% - 4.69\%) / 10\% = -1.9\%$$

$$Y: (7.9\% - 4.69\%) / 14\% = 22.9\%$$

$$Z: (6.9\% - 4.69\%) / 12\% = 18.4\%$$

(iii)

I recommend asset mix Y. Asset mix Y would be the most optimal as it has the highest safety-first ratio. While asset mix W provides the highest expected return, asset mix Y's lower volatility increases expected utility and provides same utility as asset mix Z but with a higher safety-first ratio. Unlike asset mix X, still provides enough expected income to meet the excess liability cash flow in 12 months as indicated by the positive safety-first ratio.

45. ILA LAM Fall 2023, Question 4

Learning Outcome(s): 2b, 2c, 2d

Source Materials: INV101-103-25: Elements of an Investment Policy Statement for Institutional Investors, CFA Institute; Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5, Ch 6

Commentary on Question:

For part (i), candidates generally were able to list return objectives and risk tolerances but commonly did not provide any justification and application. Partial credit was giving for just listing return objective and risk tolerance correctly.

For part (ii) many students only received partial credit by only listing general constraints and failing to apply and provide an explanation why the company should consider them.

- (i) Return objectives: 1. Earn a sufficient return to fund all policyholder liabilities and exceed the expected return used in pricing, including the minimum interest guarantee. 2. Increase the value of the company's surplus through capital appreciation to fund future expansion

Risk tolerance: Needs to ensure all policyholder liabilities can be met. Based on recent difficulties senior management is more concerned with solvency than aggressive growth, so risk appetite is fairly low. Consider tough competitive environment, capital considerations, asset ratings, interest rate risk, credit risk

- (ii) Liquidity: All policyholder obligations must be met. This includes death benefit, but also timing of possible lapses, policy loans, or universal life withdrawals

Time horizon: Long term, will establish duration targets for assets in line with liabilities

Regulatory: Comply with all insurance code in governing location. This includes build up of value within universal life contract

Tax: Monitored to provide most favourable after-tax returns

Review schedule: reviewed annually by board of directors

Asset allocation: Asset allocation designed to achieve objectives stated above. Should recognize constraints listed. Need to set asset allocation ranges and ensure these are met at all times

Rebalancing: Moderate rebalancing frequency (to minimize costs while still address market movement) is required.

(b) The following is the company's current asset allocation strategy:

Asset Class	Target Allocation	Permissible Range
Treasury bonds	25%	20% - 40%
Bonds (municipal and corporate)	25%	20% - 40%
Equities (domestic, international, and mortgages)	20%	10% - 30%
Commercial paper	15%	5% - 25%
Cash	15%	5% - 25%

Your manager believes the asset allocations should be adjusted over time as the market shifts.

Assess the asset allocation strategy.

Commentary on Question:

Candidates generally performed well on this section. Partial marks were awarded for commenting on overall portfolio allocation, and full marks for those commenting on different assets as well.

This allocation breaks one of the key rules of asset allocation, which is that assets within a class should be homogenous. Need to set separate allocation for each unique asset, grouping them reduces effectiveness.

An ideal asset allocation should provide sufficient liquidity to ensure that the policyholder obligations can be met.

Treasury bonds are long term and with disintermediation risk, as their value drops with rising interest rates. This poses a problem when used to back long-term liabilities.

Although commercial paper is generally short-term, it is not a reliable source of funding as it is unsecured and lack of secondary market. 15% allocation of CP in the portfolio is too high for the risks they pose.

While cash is very liquid, holding large amount of cash will jeopardize the goal of earning more than the expected return as it provides no earning potential

While the overall asset allocation should be reviewed periodically, the goal is not to constantly refine the allocations based on short-term market movements. The portfolio must be rebalanced if an asset class weight moves outside the permissible range. Setting permissible ranges mitigate against systemic risk. By allowing them to move frequently it increases the risk faced by the company.

(c) Critique each of the following statements for structuring a portfolio:

- A. *You can evaluate and identify assets with misaligned credit ratings to build a portfolio that will outperform a benchmark.*
- B. *The assets purchased should be matched to the average duration of the liabilities. By doing this, it will protect against all changes in the market yield curve.*

- C. *A portfolio should be built to track a benchmark index. This can reduce fees compared to investing in the assets that are part of the index directly. Given it is unlikely the portfolio will perfectly track the index, the focus for selecting assets should be on expected returns.*
- D. *Interest rate swaps can help reduce interest rate risk and improve returns. You can also consider buying forwards for specific points in the future as an alternative.*

Commentary on Question:

Candidates generally performed well on this section. To receive full credit, candidates needed to explain why the statement was correct or incorrect.

- A. It's true that you can perform your own credit analysis and potentially beat market expectations this way. However, leveraging this strategy requires an actuary with experience and could be costly to set up without the appropriate expertise
- B. It has been shown that matching the duration of the portfolio to the average duration of liabilities is not sufficient to immunize multiple liabilities. Each liability should be separately immunized. This strategy, even if employed correctly, only mitigates against parallel shifts in the yield curve. This will not mitigate the risk of a non-parallel shift (twist) of the yield curve
- C. Correct, full replication of an index is costly, so by putting together a simpler portfolio it will save on costs
- D. Earnings from an interest rate swap can only happen if you are betting on the direction of the interest rate market. Given the investment actuary believes rates will rise this could be leveraged to sell swaps for a gain, but only if that information is not already known in the market. It could also be costly with transactions fees compared to other approaches. Purchasing forwards is a way to replicate an interest rate swap but come with much higher costs and is not a good strategy

- (d) The company is evaluating bonds to add to the portfolio that backs a 10-year liability. Prevailing market interest rates are increasing and expected to continue to rise. You are given the following information:

Bond	Coupon Rate	Coupon Frequency	Term (years)	Yield to Maturity	Maturity Value
Bond 1	11%	Semi-annual	10	5.0%	\$1,000
Bond 2	7%	Semi-annual	20	6.1%	\$1,000
Bond 3	0%	N/A	15	2.2%	\$1,000
Bond 4	6%	Semi-annual	5	8.4%	\$1,000

- (i) Calculate the price of each bond.
- (ii) Recommend a bond to add to the portfolio from the options above. Justify your answer.

Commentary on Question:

Most students did well on the calculation. The most common mistake was not correctly converting the given annual rates into semi-annual rates for both the coupon and yield to maturity.

- (i)

							SAME ANSWER
Bond	Coupon Rate	Coupon frequency	Term (years)	Yield to Maturity (annual)	Maturity Value		Price
Bond 1	11%	Semi-annual	10	5.0%	1000		\$1,467.67
Bond 2	7%	Semi-annual	20	6.1%	1000		\$1,103.18
Bond 3	0%	N/A	15	2.2%	1000		\$720.22
Bond 4	6%	Semi-annual	5	8.4%	1000		\$903.63

$$Price = \sum_{t=1}^{Term*2} \frac{Coupon Rate * .5 * Maturity Value}{(1 + YTM * .5)^t} + \frac{Maturity Value}{(1 + YTM * .5)^{Term*2}}$$

$$\text{Calculation for bond 1: } \sum_{t=1}^{20} \frac{0.055*1000}{(1.025)^t} + \frac{1000}{(1.025)^{20}} = 1,467.67$$

Repeat for bonds 2 through 4.

(ii)

Normally, the higher the coupon rate and the higher the YTM, the higher the reinvestment risk. However, these are less significant in a rising interest rates environment. Since the yield is expected to rise, it is the most beneficial to invest in the short-term asset and reinvest later at a higher rate.

Based on above, make recommendation on Bond 4

46. ILA LAM Fall 2024, Question 5

Learning Outcome(s): 2c, 1b

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 5; Commercial Real Estate Analysis and Investments, Miller & Geltner, 3rd Edition, 2014 Ch 12, Ch 14; The Handbook of Traditional and Alternative Investment Vehicles, Anson, Fabozzi, Johns, 2011; Handbook of Fixed Income Securities, Fabozzi, Frank J., 9th Ed Ch 10, Ch 22

Solution:

(a) Describe two differences between TAA and SAA.

Commentary on Question:

This question tests candidate's understanding of common asset allocation methods. Most of candidate did well on this question and can explain the key difference between SAA and TAA

Strategic asset allocation (SAA) sets an investor's desired long-term exposures to systematic risk, while Tactical asset allocation (TAA) involves making short-term adjustments to asset-class weights based on short-term predictions of relative performance among asset classes.

(b) Critique the following statements regarding asset allocation:

- A. *We should never add an asset class to our portfolio if the Sharpe ratio of the new asset class is lower than the Sharpe ratio of the existing portfolio.*
- B. *Measuring growth based on a money-weighted return basis will always be materially different from using a time-weighted return basis.*
- C. *Yield-to-maturity considers interest-on-interest, and it assumes that the coupon payments can be reinvested at an interest rate equal to the coupon rate.*
- D. *Prepayments on a mortgage only occur when rates decrease.*
- E. *If the default rate on a corporate bond is higher than its credit spread, it would always be preferable to invest in treasuries rather than that particular corporate bond.*

Commentary on Question:

This question tests candidate's understanding of different portfolio performance measurement metrics and various asset classes including mortgages and corporate bonds. Simply answering True or False will not earn partial credit; Candidates must clearly state the limitations of the statements and propose revisions to receive full credit. While candidates generally performed well on the Statement A, B, C and D, many struggled with Statement E. Candidates failed to recognize that after accounting for recovery rates, the actual default loss rate could be lower than the credit spread, meaning the corporate bond could still be a worthwhile investment.

Statement A

This statement is not correct in all cases, and it depends on the correlation of the new asset class's rate of return with the current portfolio's rate of return.

Even though the Sharpe ratio of the new class is lower, it could still be added to achieve a mean-variance improvement if the new asset class's Sharpe ratio exceeds the product of the existing portfolio's Sharpe ratio and the correlation of the new asset class's rate of return with the current portfolio's rate of return (i.e., $\text{Sharpe Ratio (new)} > \text{Sharpe Ratio (existing portfolio)} * \text{Correlation (Return of new portfolio, Return of existing portfolio)}$).

Statement B

This statement is not correct in all cases.

The money-weighted return (MWR) is sensitive to the size and timing of external cash flows to and from the account, while the time-weighted return (TWR) is unaffected by these flows.

Under "normal" conditions, these two return measures will produce similar results. However, when external cash flows occur that are large relative to the account's value, and the account's performance is fluctuating significantly during the measurement period, then the MWR and the TWR can differ materially.

Statement C

This statement is not always true.

The statement is true when the coupon rate equals to the yield-to-maturity.

However, when yield-to-maturity does not equal to the coupon rate, the yield-to-maturity assumes that the coupon payments can be reinvested at an interest rate equal to the yield-to-maturity.

Statement D

This statement is not correct.

Even though prepayments from refinancing or turnover could increase when interest rates are declining or low; some degree of turnover will take place even in high interest rate environments due to seasonality or housing affordability, (i.e., household income/housing prices).

Seasoning and defaults can also cause prepayments, and these categories of prepayments do not always depend on the interest rate environment.

Statement E

The statement is not always true.

This decision will depend on the recovery rate and whether the default rate is on a "default loss rate basis". If some non-zero recovery rate is assumed, then the default loss rate could be substantially lower than the default rate. Thus, it is possible that the default rate is higher than the credit yield spread, but the default loss rate is still lower than the credit yield spread.

- (c) Your investment team is seeking to increase yield and is investigating alternative assets. Critique the following statements:
- A. *As it is outside the expertise of an insurance company and it is hard to model, real estate investment trusts should be avoided.*
 - B. *Private equity should be managed using tactical asset allocation.*
 - C. *Collateralized loan obligations have minimal to no risk, given there is sufficient diversification in the underlying pooled loans.*
 - D. *Energy transition infrastructure is a safe investment vehicle for insurance companies to invest in.*

Commentary on Question:

The question is designed to assess candidates' knowledge of various alternative assets, including commercial real estate, private equity, collateralized loan obligations (CLOs), and energy transition infrastructure. Candidates performed reasonably well and were awarded credits for discussing features of these alternative assets. Common items that could lead to partial point deduction included:

- A. Failing to recognize that Real Estate Investment Trusts (REITs) can be modeled similarly to equity and debt securities.*
- B. Overlooking the illiquid nature of private equity investments.*
- C. Not explicitly listing the risks associated with CLOs or providing adequate explanations for these risks.*
- D. Failing to identify energy transition infrastructure as a safer alternative to traditional infrastructure investments while offering higher returns.*

Statement A – False

A real estate investment trusts (REIT) can be invested in to gain exposure to commercial real estate (CRE)

Equity REITs can be publicly traded and are legally required to pay out 90% or more of their taxable income.

As REITs are publicly traded, they can be modeled like Equities and debt securities.

Statement B – False

Private Equities are very illiquid and long term.

TAA is more appropriate when short term adjustments are made.

The goal for insurance companies is to maintain a level of liquid assets and fulfilling funding commitment for PE direct investments.

Statement C – False

Collateralized loan obligations (CLOs) have following risks:

Credit Risk: Given the profile of the underlying loans, they can default.

Interest Rate Risk: CLOs with fixed interest rates will decline in value when interest rate rise.

Prepayment risk: Arises if loans are paid off before scheduled dates.

Liquidity risk: Lower CLO tranches have higher illiquidity.

Statement D – Partially True

Insurance companies have financed infrastructure classes. Energy transition infrastructure is used to produce renewable, environment-friendly energy, which is a much safer alternative asset category that offer same benefits as traditional energy infrastructure to provide entry to a high growth market. However as real assets, energy transition infrastructure investment still poses some risks from sustaining operations and financing. The main risks are operating risk, technology risk, technology risk, political risk etc.

47. QFI PM Fall 2022, Question 4

Learning Outcome(s): 2d, 2j, 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 6, Ch 19

This question tests candidates' ability to evaluate alternate investment assets from both a performance and risk characteristic perspective.

Solution:

- ~~(a) List two reasons why it may be appropriate to use an ALM approach for the pension plan:~~

Commentary on Question:

~~The candidates performed above average on this section. Most candidates were able to list that the liabilities are interest rate sensitive. Candidates often missed that the penalties for not meeting liability obligations are high.~~

~~The following items would be considered acceptable reasons for why it is more appropriate to use ALM:~~

- ~~• Liabilities are interest rate sensitive~~
- ~~• There are high penalties for not meeting obligations~~

- (b) For each of the alternative asset classes:

- (i) Calculate the Sharpe ratio, assuming a 3% risk-free rate.
- (ii) Assess whether adding the asset class to the portfolio achieves a mean-variance improvement.

Commentary on Question:

The candidates performed above average on this section. Candidates calculated the Sharpe ratios for each portfolio correctly. Several candidates lost marks for either failing to state the criteria for including an asset class in a portfolio or incorrectly calculating the standard deviation of returns.

The definition of the Sharpe ratio is $Sharpe\ Ratio = \frac{E(R_p) - R_F}{\sigma_p}$, where $E(R_p)$ is the expected return on portfolio/asset, σ_p is the standard deviation of the return on portfolio/asset, and R_F is the risk free rate.

Based on the above definition, the Sharpe ratios for each asset class is:

	Current Portfolio	TIPS	Real Estate	Private Equity
Expected total return (annual)	6%	8%	7%	10%
Standard deviation (annual)	10%	20%	18%	30%
Correlation with current portfolio	1	0.7	0.6	0.8
Duration	20	19	N/A	N/A
Sharpe Ratio	0.300	0.250	0.222	0.233

A new asset class should be added to a portfolio when the following condition is met:

$\frac{E(R_{New}) - R_F}{\sigma_{New}} > \frac{E(R_P) - R_F}{\sigma_P} \times Corr(R_{New}, R_P)$, where R_{New} is the returns on the new asset, R_P is the return on the existing portfolio, and $Corr(R_{New}, R_P)$ is the correlation between the two series.

The TIPS asset class and real estate asset class meets the risk-adjusted returns requirement. Private equity does not meet the risk-adjusted return requirement.

- (c) Evaluate how well each asset class addresses the above-mentioned concerns.

Commentary on Question:

The candidates performed brilliantly on this section. Most candidates correctly identified the underlying risks that management was concerned about, as well as provide adequate assessments on if each asset class meets those requirements. Candidates lost marks for incorrectly indicating that private equity and direct real estate investments are liquid assets. Another common mistake was candidates incorrectly stating that private equity returns are not correlated with inflation.

With a large number of plan members coming close to retirement, there is an increased liquidity concern due to the cash value option of the portfolio. Real estate (direct ownership) and private equity are highly illiquid assets, so investing in these asset classes may be risky. TIPS trade in a liquid market. As a result, TIPS satisfy the first risk criteria.

Indexed benefits grow with time – will need assets that are correlated with inflation to help manage inflation risk. All three asset classes are correlated with inflation rates, which would make them suitable.

- (d) Recommend an asset class in which to invest.

Commentary on Question:

The candidates performed as expected on this section. Most candidates correctly identified that TIPS were the appropriate asset class to invest in. Candidates received points for describing alternate investment approaches such as derivatives to address the pension's risk concerns. Many candidates did not elaborate enough on why TIPS address the portfolio management team's concerns, as opposed to real estate and private equity.

Based on analysis in parts (b) and (c), the TIPS asset class successfully meets the criteria needed by the pension fund – risk-adjusted returns, liquidity, and correlation with inflation are all addressed. The real estate asset class does not have sufficient liquidity to support the pension plan, so it should be avoided. The private equity asset class does not have liquidity or risk-adjusted returns that are sufficient to meet the needs of the pension plan.

48. QFI PM Spring 2023, Question 5

Learning Outcome(s): 2k

Source Materials: Portfolio Management in Practice Vol 1: Investment Management, CFA Institute, 2021 Ch 19

Solution:

- (a) Justify, based on the Sharpe Ratio, which portfolio is preferable in the asset-only asset allocation strategy?

Commentary on Question:

Candidates performed brilliantly on this question. Most candidates got full marks.

The Sharpe Ratio of portfolio 1 is:

$$\frac{\mu_i - R_f}{\sigma_i} = \frac{2.46\% - 1.5\%}{1.71\%} = 0.561$$

The Sharpe Ratio of portfolio 2 is:

$$\frac{\mu_i - R_f}{\sigma_i} = \frac{2.09\% - 1.5\%}{0.78\%} = 0.7564$$

Hence, portfolio 2 is preferable.

- (b) Describe the shortcomings of the Sharpe ratio in measuring the trade-off between risk and return in an asset-liability framework.

Commentary on Question:

Candidates performed above average on this question. Most candidates were able to identify that the Sharpe Ratio ignores the presence of liability. Many candidates were able to identify that the Sharpe Ratio is a one-period measure.

The Sharpe Ratio considers only the risk and return of assets and ignores the presence of any liability stream. In other words, it ignores the ability of the portfolio hedge against changes in the value of liabilities.

Sharpe Ratio is a theoretically well-founded concept only in a one-period model.

Assuming that a pension fund cares only about the distribution of assets (or the surplus) at one future point in time is inappropriate.

It unclear how to choose the future date.

A pension fund will care about funding characteristics in intermediate periods.

INV 101

LEARNING OBJECTIVE 3

ILLUSTRATIVE SOLUTIONS

These Illustrative Solutions are meant to demonstrate the level of knowledge to earn full credit on each Sample Question. They are not meant to depict a perfect solution, and candidates are encouraged to review the relevant Source Materials in conjunction with the solution as provided.

Illustrative solutions have been modified to reflect the current Syllabus. In the case where any part of the solution is no longer contained within the current Syllabus the old solution is struck through (for example, ~~this part of the solution is no longer valid~~). Where the current Syllabus differs from the prior but can be used to answer the question the modified solution is indicated in **blue font**.

Table of Contents

1. QFI PM Fall 2020, Question 13	5
Learning Outcome(s): 3c	5
Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 3.....	5
2. QFI PM Fall 2020, Question 14	9
Learning Outcome(s): 3c	9
Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 4.....	9
3. QFI PM Spring 2021, Question 8.....	12
Learning Outcome(s): 3a, 3b.....	12
Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4, Ch 13	12
4. QFI PM Spring 2021, Question 8.....	17
Learning Outcome(s): 3c	17
Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 4.....	17
5. QFI PM Fall 2021, Question 3	19
Learning Outcome(s): 3c	19
Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 4.....	19
6. QFI PM Fall 2021, Question 11	24
Learning Outcome(s): 3c	24
Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 3.....	24
7. QFI PM Spring 2022, Question 10	26
Learning Outcome(s): 3c	26
Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 3.....	26
8. QFI PM Spring 2022, Question 14.....	29
Learning Outcome(s): 3a	29
Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 1, Ch 4	29
9. QFI PM Spring 2022, Question 15	30
Learning Outcome(s): 3c	30
Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1, Ch 2	30

10. QFI PM Fall 2022, Question 10	32
Learning Outcome(s): 3a, 3b.....	32
Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4, Ch 13	32
11. QFI PM Fall 2022, Question 15	34
Learning Outcome(s): 3c	34
Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1, Ch 2	34
12. QFI PM Spring 2023, Question 9	37
Learning Outcome(s): 3a, 3b.....	37
Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4, Ch 13	37
13. QFI PM Fall 2023, Question 5	40
Learning Outcome(s): 3b	40
Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 13	40
14. QFI PM Spring 2024, Question 13	43
Learning Outcome(s): 3a, 3b.....	43
Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4.....	43
15. QFI PM Fall 2024, Question 6	46
Learning Outcome(s): 1a, 3a, 3b	46
Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021, Ch 22	46
16. QFI IRM Fall 2023, Question 3	50
Learning Outcome(s): 3c	50
Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1 - 4	50
17. QFI IRM Spring 2024, Question 4	52
Learning Outcome(s): 3c	52
Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1 - 4	52

1. QFI PM Fall 2020, Question 13

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 3

This question tested modeling approaches for correlated mortgage defaults, including characteristics of the credit risk model and how the models are applied.

Solution:

- (a) Identify desired characteristics of the credit risk model that make the choice of $p(Z)$ important.

Commentary on Question:

In order to receive full points, candidates must identify both fat-tailed and strongly dependent. Partial points were given if candidates identified other reasonable characteristics, for example, $p(Z) \in [0, 1]$.

Fat-tailed and strongly dependent are desired characteristic of the credit risk model.

- (b) Calculate the following:
- (i) Expected probability of default for a mortgage
 - (ii) Variance of the probability of default
 - (iii) Covariance between the number of defaults for any two mortgages
 - (iv) Variance of the number of defaults for the portfolio

Commentary on Question:

The candidates performed poorly on this section. Most candidates calculated part (i) correctly; however, most candidates failed to calculate part (iv). Some candidates wrongly used $\text{Var}(I_{Dn})$ instead of $\text{Var}(p(Z))$ in the formula.

$$(i) \quad E[I_{Dn}] = p = \exp(\mu + \sigma^2/2) = e^{\ln(1/40)} e^{\ln(4)/2} = (1/40) \times \sqrt{4} = 0.05$$

$$(ii) \quad \text{Var}(I_{Dn}) = p(1-p) = 0.05 \times (1-0.05) = 0.0475$$

$$(iii) \quad \text{Cov}(I_{Dn}, I_{Dm}) = \text{Var}(p(Z)) \text{ thus } = (\exp(\sigma^2) - 1) \times \exp(2\mu + \sigma^2) \\ = (e^{\ln(4)} - 1) \times e^{2\ln(1/40)} e^{\ln(4)} \\ = (4-1) \times (1/1600) \times 4 = 12/1600 = 0.0075$$

$$(iv) \quad \text{Variance of the number of defaults for the portfolio} \\ = N p (1-p) + N (N-1) \text{Var}(p(Z)) = 1000 \times .05 \times (1-.05) + 1000 \times 999 \times 0.0075 = 7540$$

- (c) Calculate the amount of capital required to cover expected losses plus two 2 standard deviations above the expected losses due to default for the portfolio.

Commentary on Question:

The candidates performed poorly on this section. Many candidates solved for α and β correctly. Some candidates calculated $\text{Var}(Z)$ correctly. However, some candidates wrongly used $\text{Var}(Z)$ instead of $\text{Var}(Dn)$ in the final calculation.

$$p = E[p(z)] = E[\text{Beta}(\alpha, \beta)] = \alpha / (\alpha + \beta) = 0.1$$

$$\text{and } \rho_{n,m} = 1 / (\alpha + \beta + 1) = .1$$

$$\text{solve for } \alpha \text{ and } \beta, \alpha = .9 \text{ and } \beta = 8.1$$

$$\rho_{n,m} = \text{Cov}(I_{Dn}, I_{Dm}) / (\sqrt{\text{Var}(I_{Dn})} \times \sqrt{\text{Var}(I_{Dm})})$$

$$\text{where } \text{Var}(I_{Dn}) = \text{Var}(I_{Dm}) = p(1-p)$$

$$\text{and } \text{Cov}(I_{Dn}, I_{Dm}) = \text{Var}(Z) = \alpha\beta / [(\alpha + \beta)^2 (\alpha + \beta + 1)] = 0.009$$

$$E[Dn] = N E[p(z)] = 1000 \times 0.1 = 100 \quad (3.10 \text{ p.90})$$

$$\text{Var}(Dn) = N p (1-p) + N (N-1) \text{Var}(Z) = 1000 \times [0.1 \times 0.9 + 999 \times 0.009] = 9081$$

$$\sigma_{Dn} = 95.29$$

$$\text{Answer} = E[D_n] + 2 \sigma_{D_n} = \$100,000 \times (100 + 2 \times 95.29) = \$29,058,856$$

- (d) Describe two limitations of binomial-mixture models.

Commentary on Question:

The candidates performed poorly on this section. Most candidates successfully identified the first limitation (common default probability) but not the second limitation (systematic factor). Also, many candidates answered general limitations which are not related to binomial-mixture models. No points were given to those answers.

Binomial-mixture models force common default probability for all debtors/obligors, and information on individual creditworthiness is lost. Also, it is not obvious how additional systematic factors might be introduced in this framework.

- (e) Calculate the correlation factor between Urban and Rural mortgages.

Commentary on Question:

The candidates performed poorly on this section. Some candidates calculated a properly but did not calculate the final answer correctly. Partial points were given if candidates successfully identified the formula and w_1 , p_u , p_s , and p_r .

$$\rho_{u,s} = [w_1^2 / a] \times [(p_u p_s) / (\sqrt{(p_u(1-p_u))} \sqrt{(p_s(1-p_s))})]$$

$$40\% = [(.3^2) / a] \times [(10\% \times 12\%) / (\sqrt{(10\% \times (1-10\%))} \times \sqrt{(12\% \times (1-12\%))})]$$

$$a = .0277$$

$$X = [w_1^2 / a] \times [(p_u p_r) / (\sqrt{(p_u(1-p_u))} \sqrt{(p_r(1-p_r))})]$$

$$X = [(.3^2) / .0277] \times [(10\% \times 8\%) / (\sqrt{(10\% \times (1-10\%))} \times \sqrt{(8\% \times (1-8\%))})] = 31.94\%$$

2. QFI PM Fall 2020, Question 14

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 4

Commentary on Question:

Overall candidates performed below average on the question. Several candidates did not answer the question or answered only one or two parts of the question. Candidates that answered all parts of the question performed above average.

- (a) Derive the covariance matrix of $[Y_1, Y_2]$ by determining $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, and identify their joint distribution

Commentary on Question:

Candidates who answered this part of the question performed as expected. Candidates who performed poorly stated the answer for the covariance matrix without providing a derivation. Candidates who did well provided a derivation.

$$\begin{aligned} E(Y_i) &= E(\sqrt{\rho}G + \sqrt{1-\rho}\epsilon_i) = \sqrt{\rho}E(G) + \sqrt{1-\rho}E(\epsilon_i) \\ &= \sqrt{\rho}(0) + \sqrt{1-\rho}(0) = 0 \end{aligned}$$

$$\begin{aligned} \text{Var}(Y_i) &= \text{Var}(\sqrt{\rho}G + \sqrt{1-\rho}\epsilon_i) = \rho\text{Var}(G) + (1-\rho)\text{Var}(\epsilon_i) \\ &= \rho(1) + (1-\rho)(1) = 1 \end{aligned}$$

$$\begin{aligned} \text{Corr}(Y_1, Y_2) &= \text{Cov}(Y_1, Y_2) = E\left((Y_1 - E(Y_1)) * (Y_2 - E(Y_2))\right) = E(Y_1 Y_2) \\ &= E\left((\sqrt{\rho}G + \sqrt{1-\rho}\epsilon_1) * (\sqrt{\rho}G + \sqrt{1-\rho}\epsilon_2)\right) = E(\rho G^2) = \rho\text{Var}(G) = \rho \end{aligned}$$

Therefore, the covariance matrix of $[Y_1, Y_2]$ is

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}$$

and their joint distribution is multivariate standard normal distribution

$\mathcal{N}(0,1, \rho)$

- (b) Determine an expression for the values of G which will satisfy the condition $p_i < p_i(G)$, for a given value of ρ .

Commentary on Question:

Candidates who answered this part of the question performed as expected.

Candidates who performed poorly started from the wrong equation.

Candidates who did well recognized how to solve for G .

$$\begin{aligned}
 p_i &= \Pr(Y_i < K_i) \\
 &= \Phi(K_i) \\
 p_i(G) &= \Pr(Y_i < K_i \mid G) \\
 &= \Pr(\sqrt{\rho}G + \sqrt{1-\rho}\epsilon_i < K_i \mid G) \\
 &= \Pr\left(\epsilon_i < \frac{K_i - \sqrt{\rho}G}{\sqrt{1-\rho}} \mid G\right) \\
 &= \Phi\left(\frac{K_i - \sqrt{\rho}G}{\sqrt{1-\rho}}\right)
 \end{aligned}$$

$$\text{If } p_i < p_i(G), \text{ then } K_i < \frac{K_i - \sqrt{\rho}G}{\sqrt{1-\rho}}$$

$$\text{Solving for } G, \text{ when } G < \frac{K_i - K_i\sqrt{1-\rho}}{\sqrt{\rho}}, \text{ then } p_i < p_i(G)$$

- (c) Explain why the default correlation between obligors is different than the correlation between latent variables Y_i .

Commentary on Question:

Candidates who answered this part of the question performed below average. Candidates who performed poorly did not explain the difference between the two correlations. Candidates who did well explained how the correlations are different.

The correlation parameter ρ is the correlation between the latent variables, which can be interpreted as representing the credit health of the obligors.

The default correlation is focused only on correlation of default events, regardless of the value of the latent variables at default.

They are different because:

- The latent variables can be highly correlated, but depending on other parameters such as the thresholds K_i , the obligors could have very different probabilities of default and low default correlation.
- The default correlation depends on more than the latent variables, such as the joint probability of default.
- The correlation parameter is the correlation between two normal random variables, whereas the default correlation is the correlation between two Bernoulli random variables that are transformations of the normal (latent) variables.

- (d) Describe advantages that a threshold model using X_i as latent variables has over the Gaussian threshold model using Y_i .

Commentary on Question:

Candidates who answered this part of the question performed above average. Candidates who performed below average did not recognize the relationship between the t distribution and tail dependence. Candidates who did well fully explained the advantages of the X variable over the Y variable.

The Y_i latent variables are normally distributed do not exhibit tail dependence which means that Y_i are asymptotically independent.

This is a problem because credit risk is primarily concerned with the tail of the distribution.

The X_i latent variables are t -distributed random variables.

The tail-dependence coefficient is non-zero for the t -distribution for all values of $\rho \in (-1,1)$ and $\nu > 0$. This means that there is tail dependence for this distribution.

- (e) You are given that the covariance between any two X_i is 20% and the expectation of $1/W$ is 0.0556.

Calculate the correlation between any two X_i .

Commentary on Question:

Candidates who answered this part of the question performed above average. Candidates who performed poorly did not choose the two correct equations to perform the calculation. Candidates who did well did.

$$\text{cov}(x_i, x_j) = \rho \cdot \left(\frac{v}{v-2}\right)$$

$$E\left[\frac{1}{W}\right] = \left(\frac{1}{v-2}\right)$$

$$\text{corr}(x_i, x_j) = \rho$$

Solve for ρ

$$v = 2 + \frac{1}{.0556} = 20$$

$$\rho = \frac{20-2}{20} \cdot 20\% = 18\%$$

3. QFI PM Spring 2021, Question 8

Learning Outcome(s): 3a, 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4, Ch 13

Commentary on Question:

This question tested candidates understanding of credit risk and of various approaches for managing that risk. They needed to correctly identify the risk present in this case. Candidates performed below average on that question. They were often asked to both list and describe or explain. When the lists were there and correct, the description or explanation were sometimes missing or deficient.

Solution:

- (a) Describe each strategy's credit risk and any implications.

Commentary on Question:

Candidates performed as expected on this part. We expected them to recognize that the three strategies increased the credit risk and how and why that credit risk increased. Not many candidates identified the implications from those strategies, especially the capital implications.

-High-yield bond

- high-risk/high-reward
- high risk of default, thus increase credit risk
- increase the capital needed

-Derivative position

- introduce counterparty risk
- may reduce risk by:
 - requiring collateral
 - carefully choosing counterparty
 - avoid concentration by spreading exposure across different counterparties

- Stop loss reinsurance
 - counterparty risk
 - subject to financial health of the reinsurer
- All 3 strategies increase credit risk
- Size of credit risk should be measured with due diligence
- Increased capital requirements

- (b) Describe four dimensions by which to analyze and compare the credit exposures of individual contracts.

Commentary on Question:

Candidates performed as expected on this part. They generally identified the dimensions correctly, but the description was often missing. The description did not need to be long and detailed.

- exposure
 - amount of money at risk
- default probability
 - likelihood of default
- recovery rate
 - amount of money relative to exposure that can be recovered
- tenor
 - time period in which some or all of the money is outstanding

- (c) Describe stress testing for credit risk and how it can complement quantitative risk measurement approaches such as value-at-risk.

Commentary on Question:

Candidates performed below average on this part. They mostly correctly described the basic of stress testing, but answers were short and incomplete. The main idea was to identify what stress testing is doing that VAR is not doing, and how: in particular, financial consequences of event occurring in the tail of the distribution, beyond the VAR definition.

Stress-testing:

- evaluating economic consequences of unexpected but plausible events
- allow for looking at extreme and hypothetical events
- company specific scenarios: no one size fits all
- must identify main factors that influence financial performance

Value-At-Risk:

- parameters reflect historical economic circumstances
- capture data across economic cycles
- may fail to account and evaluate event in the tail of the distribution, which stress testing can
- VAR adds a probability dimension to the mark to market concept
- probability-weighted distribution of exposures

- (d) Describe the purpose and key aspects of each of credit portfolio management (CPM) levels 1 and 2, as described in Handbook of Credit Risk Management.

Commentary on Question:

Candidates performed below average on this part. Most answered with an almost complete list for level 1 CPM, but a description of each item was required for full credit. The list on its own was only given partial credit even if complete. The descriptions did not need to be long. 4 items for each level, along with descriptions, were required to receive full credit.

Level 1: Basic CPM

- Aggregation : measuring accumulation of risk for each counterparty
- Reporting : frequent and regular update on the content of the portfolio
- Credit limit : Define and implement the absolute amount of exposure the firm wants to take.
- Surveillance : monitoring the performance
- Mitigation : transfer of risk

Level 2 : intermediate CPM

- Capital: quantification of the required capital at the firm's level

- Allocation of capital and profitability at transaction level
- Stress testing : evaluation economic consequences of unexpected events
- hedging strategy: managing the risk of unwelcomed risk by buying protection or any other transaction that reduced consequences from those risk (definition of hedging)
- rebalancing :optimize the allocation of capital by updating the composition of the portfolio.

4. QFI PM Spring 2021, Question 8

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 4

Commentary on Question:

This question tests the candidates understanding of one-factor Guassian Vasicek limit loss models.

Solution:

- (a) Describe any simplifying assumptions or insights required in order for this approximation to be valid.

Commentary on Question:

Candidates performed below average on this part. Candidates that identified and briefly described each of the points mentioned below received full credit. Most candidates received some credit for describing only the first and second bullets.

- The probability of default is the same for each obligor or the portfolio is homogenous.
- Each obligor in the portfolio has the same exposure, recovery, and loss given default. The portfolio is infinitely grained.

- $p(G)$ is strictly a decreasing function of G , decreases in G will lead to increased probability of default.
- The target variable, number of defaults in the portfolio, is redefined from D_n to $D_n^* = D_n/N$, which is the proportion of defaults in the portfolio.

- (b) Calculate the probability that the number of defaults for the portfolio is less than or equal to 15, using your analytic approximation.

Commentary on Question:

Candidates performed poorly on this part. Most candidates did not receive credit for using an incorrect formula, Many candidates that used the correct formula received full credit.

$$P(D_n^* \leq x) = \Phi((\sqrt{1-\rho} \cdot \Phi^{-1}(x) - \Phi^{-1}(p))/\sqrt{\rho})$$

$$x = 15/1000 = 1.5\%$$

$$\rho = 10\% \text{ based on the latent variable}$$

$$p = 1\%$$

$$P(D_n^* \leq x) = 80\%$$

- (c) You decide to revise your model and modify the latent variable for each obligor in the Gaussian threshold model to the following:

$$y_n = \sqrt{V} \left(\sqrt{10\%} G + \sqrt{90\%} \epsilon_n \right)$$

where G and ϵ_n are independent and identically distributed standard normal variates for all $n \in \{1, \dots, 1000\}$ and V is a gamma distributed random variable.

Describe drawbacks of this revised model.

Commentary on Question:

Candidates performed below average on this part. Most candidates received partial credit for identifying one or two drawbacks. Those candidates that identified at least four of the points mentioned below received full credit.

- The gamma distribution lacks a power tail
- The model lacks positive tail dependence.
- The models are not analytically tractable.
- Require specialized functions and large number of computations, slowing determination of risk measures
- The models are not popular and do not appear often in the academic literature

(d) Calculate $E[V^2]$.

Commentary on Question:

Candidates performed poorly on this part. Some candidates did not utilize the information provided on the kurtosis and received no credit. Those Candidates that recognized the correct formula and were successfully able to solve for the answer received full credits.

$$\begin{aligned}
 \text{cov}(y_n, y_m) &= \rho \cdot E[V] \\
 E[V^2] / E[V]^2 &= 4/3 \\
 E[V^2] &= E[V]^2 \cdot 4/3 \\
 &= (\text{cov}(y_n, y_m) / \rho)^2 \cdot 4/3 \\
 &= (8\% / \rho)^2 \cdot 4/3 \\
 &= 0.8^2 \cdot 4/3 \\
 &= .8533
 \end{aligned}$$

5. QFI PM Fall 2021, Question 3

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 4

Commentary on Question:

This question tests the candidate's understanding of performance evaluation, as well as the fundamentals underlying benchmarks.

Solution:

- (a) Derive the covariance matrix of $[y_1, y_2]$.

Commentary on Question:

Candidates performed as expected on this section. A handful of candidates confused covariance matrix with a correlation matrix and did not derive the variances of y_1 and y_2 .

$$E(Y_1) = E(\sqrt{\rho_1}G + \sqrt{1 - \rho_1}\varepsilon_1) = \sqrt{\rho_1}E(G) + \sqrt{1 - \rho_1}E(\varepsilon_1) = \sqrt{\rho_1}(0) + \sqrt{1 - \rho_1}(0) = 0$$

$$\begin{aligned} E(Y_2) &= E(\sqrt{\rho_2}G + \sqrt{1 - \rho_2}\varepsilon_2) = \sqrt{\rho_2}E(G) + \sqrt{1 - \rho_2}E(\varepsilon_2) \\ &= \sqrt{\rho_2}(0) + \sqrt{1 - \rho_2}(0) = 0 \end{aligned}$$

$$\begin{aligned} Var(Y_1) &= Var(\sqrt{\rho_1}G + \sqrt{1 - \rho_1}\varepsilon_1) = \rho_1 Var(G) + (1 - \rho_1)Var(\varepsilon_1) = \\ &\rho_1(1) + (1 - \rho_1)(1) = 1 \end{aligned}$$

$$\begin{aligned} Var(Y_2) &= Var(\sqrt{\rho_2}G + \sqrt{1 - \rho_2}\varepsilon_2) = \rho_2 Var(G) + (1 - \rho_2)Var(\varepsilon_2) = \\ &\rho_2(1) + (1 - \rho_2)(1) = 1 \end{aligned}$$

$$\begin{aligned} Corr(Y_1, Y_2) &= Cov(Y_1, Y_2) = E((Y_1 - E(Y_1)) \times (Y_2 - E(Y_2))) = E(Y_1 Y_2) = \\ &E((\sqrt{\rho_1}G + \sqrt{1 - \rho_1}\varepsilon_1) \times (\sqrt{\rho_2}G + \sqrt{1 - \rho_2}\varepsilon_2)) = E(\sqrt{\rho_1}\sqrt{\rho_2}G^2) = \\ &\sqrt{\rho_1}\sqrt{\rho_2}Var(G) = \sqrt{\rho_1}\sqrt{\rho_2} \end{aligned}$$

The covariance matrix of $[Y_1, Y_2]$ is:

$$\begin{bmatrix} 1 & \sqrt{\rho_1}\sqrt{\rho_2} \\ \sqrt{\rho_1}\sqrt{\rho_2} & 1 \end{bmatrix}$$

Candidates could use generalized variables such as $E(Y_i)$ but they are expected to substitute back $i = 1$ and 2 to arrive at covariance as $\sqrt{\rho_1}\sqrt{\rho_2}$ in the final step.

- (b) Explain the implications of using the simplified model your coworker recommends.

Commentary on Question:

Candidates performed below average on this section. While most candidates could point out the statistical feature of the simplified structure, very few of them successfully highlighted the difference against the original structure in order to explain the implications of using the simplified model.

- The coworker's structure has a simplistic pattern in the correlation structure. Both bond obligors depend on the global factor G in the same way.
- The coworker's structure has a common covariance between all state variables.
- My structure has each credit counterparty affected by the global state variable in a different way
- My structure will have 3 parameters that need to be estimated. (If this was extended to include a larger portfolio of N bonds it would lead to $N+1$ parameters, in this case $N=2$.) Therefore the simplified model could reduce the computational efforts and statistical power of the estimated parameters.

- (c) Derive an expression for $\rho(\mathbb{I}_{\mathcal{D}_1}, \mathbb{I}_{\mathcal{D}_2})$, the correlation between default variables $\mathbb{I}_{\mathcal{D}_1}$ and $\mathbb{I}_{\mathcal{D}_2}$.

Commentary on Question:

Candidates performed below average on this question. Approximately half of the candidates successfully defined correlation and worked through covariances, variances, probabilities of correlated Bernoulli random variables to arrive at the answer using:

$$\rho(I_{D_1}, I_{D_2}) = \frac{\text{cov}(I_{D_1}, I_{D_2})}{\sqrt{\text{var}(I_{D_1})}\sqrt{\text{var}(I_{D_2})}} = \frac{P(D_1 \cap D_2) - P(D_1)P(D_2)}{\sqrt{P(D_1)(1 - P(D_1))}\sqrt{P(D_2)(1 - P(D_2))}}$$

The default variable is a Bernoulli random variable which allows us to simplify this further.

$$\frac{P(D_1 \cap D_2) - P(D_1)P(D_2)}{\sqrt{P(D_1)(1 - P(D_1))}\sqrt{P(D_2)(1 - P(D_2))}} = \frac{p_{1,2} - p_1p_2}{\sqrt{p_1p_2(1 - p_1)(1 - p_2)}}$$

Note that directly copying from formula sheet without the required derivation would only receive partial credit.

- (d) Explain how the expression for the correlation derived in part (c) compares to the correlation between latent variables y_1 and y_2 .

Commentary on Question:

Candidates performed poorly on this section. Candidates were not able to explain in statistical terms the differences between the correlation of latent variables and of the correlation of default variables. A few even failed to infer from the correlation expressions to conclude they are different.

From part a) of the question, we know that the correlation of the latent variables is:

$\rho(Y_1, Y_2) = \sqrt{\rho_1}\sqrt{\rho_2}$ (note from the simplified model in (b), this simplifies to just ρ)

The correlation between default variables is different from the correlation between latent variables. The difference between the two correlations are:

- The correlation for the latent variables and the default variables are similar and are related however they are different. Default correlation depends on the unconditional default probabilities and also on the joint probability of default between the two counterparties
 - The latent variables are composed of normal random variables while the default variable is a Bernoulli random variable.
- (e) Explain why it would be inappropriate to use this default trigger as defined by your coworker.

Commentary on Question:

Candidates performed as expected on this section. Most candidates were able to articulate the nature of point-probability within a continuous distribution; a few were able to extend this interpretation of the default trigger.

Computation of the probability of default is not possible if threshold is defined in this way. The probability of default is $p_n = P(D_n) = P(Y_n = K_n)$. The latent variable is a normal random variable so this probability would not be defined given it is a continuous function.

It would be difficult to interpret this default threshold in real life. The way your coworker has defined probability of default means that default only occurs at a specific value. Hence, this can be interpreted as the obligor defaults only at a specific level of financial health which would not make sense in a real world context.

Note that solely stating that an alternative trigger could be based on a range would only receive partial credits.

6. QFI PM Fall 2021, Question 11

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 3

Commentary on Question:

This question tests the concept of credit risk mixture models and its significance in risk calculation.

Overall, candidates performed as expected on this question. Some left parts of this question blank.

Solution:

a)

- (i) State the relationship between ω_0 and ω_1

Commentary on Question:

The candidates performed brilliantly on this section. Candidates that identified the sum of ω_0 and ω_1 equals to 1 received full credit.

$$\omega_0 + \omega_1 = 1$$

- (ii) Explain ω_0 , ω_1 and S using the general ideas of the CAPM framework.

Commentary on Question:

Candidates performed above average on this question. Candidates didn't mention all three factors received partial credit.

ω_0 is the idiosyncratic risk factor loading, ω_1 is the systematic risk factor loading, and we can think of S as common economic factor, a large outcome scales up the default probability for all obligors.

- b) Describe how the CreditRisk+ model in part (a) addresses one major shortcoming of binomial- and Poisson-mixture models.

Commentary on Question:

The candidates performed as expected on this section. They either received close to full credit or none. Candidates who identified the shortcoming and explained how the CreditRisk+ model handles it received full credit. The candidates must mention the individual creditworthiness to get full marks.

- One major shortcoming of all of binomial- and Poisson- mixture models is, all obligors are forced to share a common default probability and thus information on individual creditworthiness is lost.
- With the CreditRisk+ mentioned in (a), instead of a common, portfolio wide unconditional default probability of p , this approach allows each obligor to, in principle, have its own characterization of its creditworthiness.

c) Calculate each of the following:

Commentary on Question:

Overall, the candidates performed as expected on this section. Many candidates left the first part blank. Among the candidates that answered the part, some candidates applied the correct formulas but did the calculation wrong. A few candidates correctly calculated the w_1 , but did not realize w_0 is the final answer. The candidates performed as expected on the second part. Many candidates answered third part correctly.

(i) The percentage of default probability that can be explained by this classification

- $\rho_{A,B} = [w_{12} / a] \times [(p_A p_B) / (\sqrt{p_A (1 - p_A)} \sqrt{p_B (1 - p_B)})]$
- $50\% = (w_{12}) / 0.01 \times [(0.05 \times 0.1) / (\sqrt{0.05 (1 - 0.05)} \sqrt{0.1 (1 - 0.1)})]$, $w_1 = 0.2557$, so $w_0 = 1 - 0.2557 = 0.7443$

(ii) The variance of conditional default probability for C

- $\text{var}(p_C(S)) = (p_C^2 w_{12}) / a = (0.152 \times 0.25572) / 0.01 = 0.1471$

(iii) The variance of S

$$\text{var}(S) = E(S^2) - E(S)^2 = 1 + 1/a - 1 = 1/0.01 = 10$$

d) Describe critical assumptions that are needed for the multi-factor version of the model.

Commentary on Question:

Candidates performed below average on this section. Most candidates were able to provide some assumptions that are needed but not all of the critical ones.

- The first step is to add additional systematic factors $S = [S_1 \dots S_k]$
- A critical assumption is that each S_k is independent, and given S, each default event is also independent.

7. QFI PM Spring 2022, Question 10

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 3

Commentary on Question:

Overall, the candidates performed as expected for this question. Most candidates were able to get at least partial marks for parts (a) and (b).

Solution:

- (a) Describe a key shortcoming of the binomial and Poisson independent-default setting models, and how the mixture models address this shortcoming.

Commentary on Question:

The candidates performed above average in this section. Most of the candidates were able to mention the interaction of counterparties. Only a few candidates explained that assuming default independence across the portfolio may not be appropriate, and were able to obtain full marks.

The assumption of default independence is not, from a risk perspective, particularly conservative. Assuming default independence is actually a strong assumption on the potential for diversification in one's credit portfolio.

For sufficiently large portfolios, all idiosyncratic risk can be diversified away. In the limit, therefore, the risk of independent-default models can be made arbitrarily small by spreading out the specific risk of each obligor among many other equally small positions.

The most important advantage for the mixture model is they capture the inherent interaction between the default outcomes of multiple counterparties.

- (b) Calculate the following:
 - (i) Expected number of defaults for the portfolio
 - (ii) Covariance of the default indicators for any two issuers

Commentary on Question:

The candidates performed above average in this section. Partial marks were given for providing the correct formula.

$$E[I_{Dn}] = p = \exp(\mu + \sigma^2/2) = e^{\ln(1/20)} e^{\ln(9)/2} = (1/20) \times \sqrt{9} = 0.15$$

$$E[D_n] = Np = 100 \times 0.15 = 15$$

$$\text{Cov}(I_{Dn} I_{Dm}) = \text{Var}(p(Z)) = (\exp(\sigma^2) - 1) \times \exp(2\mu + \sigma^2) = (e^{\ln(9)} - 1) \times e^{2\ln(1/20)} e^{\ln(9)} = (9 - 1) \times (1/400) \times 9 = 0.18$$

- (c) Explain one advantage of mixing the Poisson model with another distribution, such as the Gamma distribution.

Commentary on Question:

The candidates performed below average in this section. Most of the candidates failed to mention how the mixing can improve the properties of the distribution, compare with the standard Poisson model.

One of the beneficial consequences of mixing the Poisson model with another distribution is that it breaks one of the standard features of the Poisson distribution: equal variance and expected value.

The base Poisson methodology fails to capture default dependence.

The loss volatility and the expected loss are both equal to a single default in the independent-default Poisson setting.

(d)

- (i) Calculate the probability that there are exactly 2 defaults for the portfolio.
- (ii) Calculate the default correlation ρ_D for any two issuers using the quick and dirty calibration method described in the Bolder reading (assuming $p(S)=S$).

Commentary on Question:

The candidates performed as expected in this section. Some candidates interpreted the parameters as pertaining to the portfolio; therefore, they divided b by 100 for section i. In those cases, equivalent credit was still given. Partial marks were given for providing the correct formula.

$$q_1 = b/(b+1) = 4/5 = 0.8$$

$$p(D_n=k) = (\Gamma(a+2)/(\Gamma(k+1) \times \Gamma(a)) \times q_1^a \times (1-q_1)^k = (\Gamma(2+2)/(\Gamma(2+1) \times \Gamma(2))) \times 0.8^2 \times (1-0.8)^2 = 0.0768$$

$$\rho_D = \text{var}(S)/(E(S)(1-E(S))) = (a/b^2)/((a/b) \times (1-a/b)) = 1/(b-a) = 1/(4-2) = 0.5$$

8. QFI PM Spring 2022, Question 14

Learning Outcome(s): 3a

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

Commentary on Question:

This question objective is to test the candidate understanding in a practical situation and to uses his/her knowledge in a specific context.

Solution:

- (a) Describe the credit risk present in this agreement.

Commentary on Question:

The candidates performed below average on this section. Most candidates received credit for correctly recognizing the prepayment risk. Most candidates did not describe the other credit risks.

- Prepayment of goods and services
 - Payments are made 30 days before delivery
 - In case of non-delivery, BYR is short 1000\$
- Derivatives
 - BYR is paying fix 1000\$
 - SLR is delivering a fix quantity, but of varying value
- Long term supply agreement

- (b) Describe the four parameters of credit risk for each of the parties.

Commentary on Question:

The candidates performed below average on this section. Many candidates received partial credit for identifying the four parameters of credit risk. A common mistake was not recognizing the dynamic nature of the exposure which was a key element of this question.

Exposure

- Gross exposure

In this agreement, there is bilateral exposure – either party could have exposure to the other

from the perspective of SLR, the exposure is limited to the value of the future payments BYR is obligated to pay

from the perspective of BYR, the exposure is limited to the value of future alternative flour deliveries SLR is obligated to make

- Net exposure
 - There is no collateral pledge here
- Dynamic exposure
 - The market price of the flour may vary within the 3 years period
 - Thus it may be more than 1000\$ per month of exposure
 - The exposure is a function of the time remaining in the contract

Default probability

- SLR is a start up, we have no history. The risk is unknown and may be high.
- BYR seems more solid, but we know little about it too.

Recovery rate

- For BYR, they may at best get their next delivery of flour
- For SLR, given that they are paid in advance, they won't have to recover any \$
- BUT, both parties will lose, a stream of income for one and delivery of goods at a guaranteed price for the other.

Tenor

- 3 years

9. QFI PM Spring 2022, Question 15

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1, Ch 2

Commentary on Question:

This question tests the candidate's understanding of basic concepts of credit risk, and considerations when constructing credit risk models.

Solution:

- (a) State a formula defining the default loss random variable in terms of the exposure at default and recovery rate of each bond, giving definitions for each term in the formula.

Commentary on Question:

The candidates performed as expected on this section. To receive full credit, candidates needed to describe or give definition for each term in the formula.

$$L = \sum_{n=1}^N EAD_n \times (1 - RR_n) \times I_n$$

EAD_n is the exposure at default of the n-th bond. It is the maximum amount that could be lost at default.

RR_n is the recovery ratio of the n-th bond. It is the ratio of the amount recovered on default over the exposure at default.

I_n is the indicator variable of default for the n-th bond, equals 1 if the n-th bond defaults and 0 if the n-th bond does not default.

- (b) Calculate the variance of the default loss defined in part (a).

Commentary on Question:

The candidates performed above average on this section. Most of the candidates were able to show full calculation of the variance. The most common mistake candidates made was to not include the total number of bonds in the portfolio.

Var (# of defaults) = # of bonds * probability of default * (1 – probability of default)

$$\text{Var (\# of defaults)} = 1000 * 0.02 * (1 - 0.02) = 19.6$$

Since the risks are independent, EAD = \$1000, and RR = 0%

$$\text{Var}(L) = \text{Var} [1000 \cdot (1 - 0\%) \cdot \# \text{ of defaults}]$$

$$\text{Var}(L) = 1000^2 \cdot \text{Var}(\# \text{ of defaults}) = 19,600,000$$

- (c) Calculate the approximate 95th percentile VaR of the default loss.

Commentary on Question:

The candidates performed above average on this section. Most candidates were able to show full calculation. The most common mistake candidates made was to not include the total number of bonds in the portfolio.

For large number of investments N and small probability of default p , the default loss distribution can be approximated using the normal distribution.

$$E(\text{default loss}) = E(\# \text{ of defaults}) \cdot \$1000 = N \cdot p \cdot \$1000$$

$$E(\text{default loss}) = 1000 \cdot 0.02 \cdot \$1000 = \$20,000$$

$$\text{Stdev}(\text{default loss}) = \text{Stdev}(\# \text{ of defaults}) \cdot \$1000 = \sqrt{N \cdot p \cdot (1-p)} \cdot \$1000$$

$$\text{Stdev}(\text{default loss}) = \sqrt{1000 \cdot 0.02 \cdot 0.98} \cdot \$1000 = \$4427$$

$$\text{VaR}_{0.95}(\text{default loss}) = \text{mean} + z_{0.95} \cdot \text{stdev} = \$20,000 + 1.64 \cdot \$4427 = \$27,282$$

10. QFI PM Fall 2022, Question 10

Learning Outcome(s): 3a, 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4, Ch 13

Commentary on Question:

This question tests the fundamentals of credit risk management. Overall, the candidates performed as expected on this question. Most candidates received at least partial marks.

Solution:

- (a) Identify the credit risk exposures of ABC Life Insurance.

Commentary on Question:

The candidates performed below average on this section. Less than half of the candidates pointed out the net exposure is \$100M.

ABC Life is exposed to the credit risks of holding the sovereign bonds of Country S. ABC Life's portfolio will incur loss when Country S's credit rating is downgraded or defaults. The net exposure of the credit risk is \$100M.

- (b) Calculate the expected loss of ABC Life Insurance at the end of 1 year.

Commentary on Question:

The candidates performed below average on this section. Some candidates correctly calculated $E[\text{Loss} \mid \text{Default}]$, but only a few candidates calculated the total expected loss correctly.

$$E[\text{Loss} \mid \text{Default}] = 0.5\% * 100M * (1 - 30\%) = 0.35M$$

$$E[\text{Loss} \mid \text{Downgrade to C}^*] = 2.5\% * 100M * 20\% = 0.5M$$

$$E[L] = E[L|D] + E[L|C^*] = 0.85M$$

- (c) Calculate the probability of bond defaulting at any point during the first 2 years.

Commentary on Question:

The candidates performed above average on this section. Most candidates calculated the correct cumulative probability.

In year 1:

Probability of A^* = 4%, Probability of B^* = 93%,

Probability of C^* = 2.5%, Probability of D^* = 0.5%

Cumulative, at end of the year 2:

Probability of D^* = $4\% \times 0\% + 93\% \times 0.5\% + 2.5\% \times 17\% + 0.5\% \times 100\% = 1.39\%$

11. QFI PM Fall 2022, Question 15

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1, Ch 2

Commentary on Question:

This question tested candidates understanding of credit risk analysis and models.

Solution:

- (a) Describe one advantage and one disadvantage of one-factor credit risk modeling.

Commentary on Question:

The candidates performed brilliantly on this section. A few candidates only listed one advantage or one disadvantage and thus received partial credit.

- Advantage: The availability of a broad range of analytical formulae for its solution and computation of ancillary model information.
- Disadvantage: May be too simple to describe more complex credit portfolios

- (b) Calculate the expectation and volatility of L .

Commentary on Question:

The candidates performed as expected on this section. Most candidates correctly calculated the expectation of L. Overall, candidates were less successful in correctly calculating the volatility of L. Partial credit was awarded for instances where candidates used correct formulas but made a calculation error.

$$E(L) = c_1 * p_1 * (1 - R_1) + c_2 * p_2 * (1 - R_2) = 2 * 100 * 0.05 * (1 - 0.3) = \$7$$

$$\sigma(L) = c_1 * (1 - R_1) * \sqrt{2 * p_1 * (1 - p_1)} = \$21.575$$

(c)

- (i) Derive an expression for the volatility of L as a function of the number of obligors N .
- (ii) Calculate the minimum number of obligors needed to reduce ABC's risk S below 5%.

Commentary on Question:

*The candidates performed below average on this section. Candidates who were successful on calculating the volatility of L in part (b), were generally more successful in deriving the expression in (c)i. For (c)ii, many candidates correctly noted that $S = L/(100 * N)$ and $(S) = \frac{\sigma(L)}{100 * \sqrt{N}}$, however, some of these candidates calculated a different number of obligors due to not deriving the correct expression in (c)i. Some candidates omitted this part of the question.*

$$(i) \quad \text{var}(L) = N * c_1^2 * (1 - R_1)^2 * \sqrt{p_1 * (1 - p_1)}$$

$$\sigma(L) = \sqrt{N} * c_1 * (1 - R_1) * \sqrt{p_1 * (1 - p_1)}$$

$$= \sqrt{N} * 100 * (1 - 0.3) * \sqrt{0.05 * (1 - 0.05)} = 15.256 * \sqrt{N}$$

(ii) $S = L / (100 * N)$

$$\sigma(S) = \frac{\sigma(L)}{100 * \sqrt{N}} = 0.1526 / \sqrt{N}$$

$\sigma(S) = 5\%$ implies $N=9.31$; therefore at least 10 obligors are needed

(d)

- (i) Explain *the Law of Rare Events* as described in the Bolder reading.
- (ii) Derive an approximation for the volatility of L based on *the Law of Rare Events* for large N, and considering $p = 0.05$ to be very small.

Commentary on Question:

The candidates performed poorly on this section. The candidates that accurately described the Law of Rare Events were generally successful in deriving the approximation in (d)ii. Many candidates omitted this part of the question.

- (i) When comparing loss distributions generated from a Binomial model $Bin(p, N)$, and a Poisson model (defined by $\lambda = Np$). If N is very large and p is very small, these two distributions will coincide with one another, i.e., experience a form of convergence.

15. Continued

- (ii) Variance from Poisson distribution is by $\lambda = Np$
So approx. $\text{vol}(L) = \sqrt{N} * 100 * .7 * \sqrt{.05} = 70 * \sqrt{.05N}$

(e)

- (i) Calculate the value of risk metric S using the approximation from (d)ii above.
- (ii) Compare your estimate to the value obtained using an exact calculation.

Commentary on Question:

The candidates performed poorly on this section. Candidates who were successful on part (d) generally performed well on part (e). Many candidates omitted this part of the question.

- (i) $N = 5000 / 100 = 50$
Using the approximation from (d)ii, $S = 70 * \sqrt{.05 * 50} / 5000 = 2.21\%$
- (ii) Exact answer: $S = \frac{0.1526}{\sqrt{N}} = 2.16\%$. Answers are very similar, suggesting N is large and p is small.

12. QFI PM Spring 2023, Question 9

Learning Outcome(s): 3a, 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4, Ch 13

Commentary on Question:

This question tests candidates' ability to identify the embedded credit risks associated with the investment strategies as well as the ability to apply relevant credit risk management functions.

Solution:

(a)

- (i) Identify the source of credit risk, if any, inherent in each element of ABC Life's current approach.
- (ii) Assess qualitatively the degree of credit risk in each element.

Commentary on Question:

Candidates performed as expected on this part. Most candidates received credit for pointing out the credit risks associated with each investment strategy. However, some candidates erroneously stated that the S&P500 funds have credit risk, while the risk of the fund is mostly market risk.

(i)

- Credit risks stem from reinsurer unable to pay the obligated claims.
- Credit risk stem from FGH bank unable to meet the obligation of the swap terms
- Credit risk stem from the mortgagee unable to make payments
- Credit risk stems from foreign sovereign downgrades or unable to make bond payments
- No credit risk, market risk only

(ii)

- The exposure to the reinsurer is small and the reinsurer has a high rating. Credit risk is small.
- The exposure is $100M * 1\% \text{ per year} = 1M$. The credit risk is small due to low exposure
- The mortgage is secured by the real estate as collateral. The credit risk is usually small, since the net exposure is small due to collateral.
- Invest \$100M in government and municipal bonds from emerging markets carries the most credit risk since the emergent market sovereign and municipal credit ratings is usually low and the recovery rate is also low.

- (b) Describe three key functions of the credit portfolio management team.

Commentary on Question:

Candidates performed as expected on this part. Most candidates received credit for recalling the necessary functions of Level 1 credit risk management. Some candidates received some credit for listing the names of the function but did not elaborate on the actual functions.

- (i) Aggregation – Measuring the accumulation of risks from each counterparty, aggregating GE, NE, AE.
 - (ii) Reporting – Provide frequent and regular updates on the content of the credit portfolio, allows the readers to quickly assess key exposure metrics
 - (iii) Credit Limit – Creating and setting credit limits that are applicable to each counterparty, set in advance and changed infrequently, enforced, subject to judgement and review, set for multiple metrics
 - (iv) Surveillance – Monitoring the performance of the transaction and counterparty after deals have been closed.
 - (v) Mitigation - firms originating credit exposures may want to transfer the credit risk they took on a counterparty to another firm.
- (c) Explain three additional key functions that need to be implemented in order to achieve this goal and the importance of each function.

Commentary on Question:

Candidates performed as expected on this part. Many candidates received credit for only providing the name of the function. Candidates that elaborated on the actual details received full credit.

Quantification of Capital at Risk – Develop quantification of capital needed to absorb the credit risks in order to protect the firm from the risk of insolvency.

Allocation of Capital and profitability at individual transaction level – Allocate the aggregated level of capital to each individual transaction. This is useful in pricing the transaction where the cost of capital forms part of the price of the transaction.

Stress Testing – Evaluating the economic consequences of unexpected but plausible events that may impact the performance of the counterparties.

Hedging strategy – Some positions can be hedged. Implement a hedging strategy that is defensive in nature.

Rebalancing transactions – Actively aim to minimize the amount of capital deployed and degenerate the highest return on the capital. Given the credit limit, the CPM team rebalances the credit portfolio such that the highest return is achieved.

13. QFI PM Fall 2023, Question 5

Learning Outcome(s): 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 13

Commentary on Question:

This question is intended to test the candidate's understanding of the Credit Portfolio Management process, along with the use of Credit Default Swaps in hedging a credit exposure. Overall, candidates performed below average on this question, especially on question (a) and (b).

Solution:

- (a) Explain the two key activities in an active CPM strategy (as defined in Bouteille).

Commentary on Question:

The candidates performed below average on this section. Most candidates were able to identify the two key activities in active CPM strategy but failed to provide the correct explanation. No credit was given for key activities not in

active CPM strategy (level 3). Partial credits were given for correct key activities but not appropriate explanation.

- **Transfer Pricing:** Transfer pricing traditionally refers to intracompany transactions like the allocation of expenses for shared services or charges associated with the purchase of a product or a service from an affiliate. In the risk-management context, the key idea of transfer pricing is to dispossess business units of their exposure immediately after closing a transaction. The ownership is transferred to the CPM group by selling the exposure via a funds-transfer price such that the originator can recognize income, which then shifts the performance burden to the CPM group, which has the responsibility to manage the portfolio it owns. The acquisition of the exposure by CPM is executed at market price, irrespective of the amount that the business units obtained from the client.
- **Acquisitions or Swaps of Exposures:** The amount of capital dedicated to credit risk can be reduced by adding diversification to the portfolio. Active CPM can involve the acquisition of exposures that the business is not able to generate. For instance, a bank may not have any presence in the food sector, whereas analytical studies reveal that it would provide diversification to the portfolio. The CPM group can be proactive and purposefully acquire exposures in the sector. A straight acquisition via credit-default swap or purchase of participations in commercial loans can be executed.

- (b) Recommend an active CPM strategy to manage the risk that Company Y defaults on its obligations to Company X.

Commentary on Question:

The candidates performed below average on this section. Most candidates were able to recommend CDS or another active CPM strategy but failed to provide the appropriate explanation and therefore received partial credit. No credit was given to candidates who recommended a non-active CPM strategy.

One possible strategy will focus on the Acquisition of Exposures concept. In this context, we should have Company X increase its credit exposure to sectors that benefit from larger rainfall. A possible strategy would be to issue a commercial loan to a farmer who benefits from extra rainfall. In this case, we have acquired additional credit exposure from the farmer, but in the case of extra rainfall (where Company Y is less likely to pay Company X given the

weather's impact on its financial strength), we are more likely to receive payment from the farmer.

Other possible strategies are purchasing CDS on Y or entering into weather derivatives as other potential hedges.

- (c) Your manager makes the following statements about CPM:
- I. Credit Risk Assessment and CPM are essentially the same discipline, requiring the exact same skill set and providing similar insights into a company's credit risk position. Both areas focus on analyzing individual transactions rather than the portfolio at-large.
 - II. Advances in liquidity and analytical tools have led to evolution of the CPM process. In particular, it has become more difficult in the last 20 years to buy/sell exposures to execute rebalancing transactions, which has turned CPM into a purely academic exercise.
 - III. Basic CPM can and should be viewed as the absolute minimum amount of activities that should be performed by any firm exposed to credit risk. It does not require sophisticated modelling in order to add value to an enterprise.

Critique each statement.

Commentary on Question:

The candidates performed as expected on this section. Most candidates were able to identify that statement III is accurate and point out of some of the inaccurate parts in statement I and II therefore were given partial credit.

I: Credit risk assessment and CPM are two complementary disciplines, staffed with people having different background and skills. The former focuses on individual deals, and the latter concentrates on the entire portfolio. Credit portfolio management is more strategic in nature, and, based on the firm's risk appetite, it sets the vision for the portfolio it wants to create and the direction that the originators should follow.

II: Credit portfolio management has evolved significantly over the last 20 years. Once reserved to large banks with large portfolios, it is now implemented by most institutions that actively generate credit exposures. Two main factors contributed to this phenomenon: analytical tools and liquidity(1gp). Mathematical advancements have made data easier to collect & analyze. In addition, it has become easier to buy/sell exposures when needed (particularly with the development of the Credit Default Swap and Credit Securitization). The statement regarding liquidity is therefore misguided.

III: This statement is accurate. Any firm exposed to any sort of credit risk should (at a minimum) be executing Level 1 (Basic) CPM in order to assist with managing its portfolio. There is no need for sophisticated analytical tools in order to effectively execute and gain value from Level 1 CPM.

14. QFI PM Spring 2024, Question 13

Learning Outcome(s): 3a, 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, 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.

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) 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.

15. QFI PM Fall 2024, Question 6

Learning Outcome(s): 1a, 3a, 3b

Source Materials: The Handbook of Credit Risk Management, Bouteille & Coogan-Pushner, 2nd Edition, 2022, Ch 4; Handbook of Fixed Income Securities, Fabozzi, F.J., 9th Edition, 2021, Ch 22

Commentary on Question:

This question tests the concept of measuring credit risk and its application to mortgage securities. Overall, candidates performed below average on this question. Some candidates provided brief descriptions that earned only partial points.

Solution:

- (a) Your manager expects that interest rates will decrease in the next few years and does not expect collateral credit loss to be a major concern. They recommend utilizing a senior subordination shifting interest structure as an internal credit enhancement structure.

Describe the mechanics of the recommended structure.

Commentary on Question:

Candidates performed below average on this part. Most candidates only described the supporting classes and loss structure and did not opine on

why the senior subordination shifting interest structure was appropriate and thus only received partial points on this part.

Shift-interest structure designed mainly to deal with prepayment risk for senior bondholders

Since interest rates are expected to decline, prepayment speeds may increase

OC/XS structure used when collateral credit loss is a concern

Senior classes have supporting classes, called mezzanines and subs.

Lockout period when all of the unscheduled principal payments are allocated to the senior tranches and the subordinate bonds are locked out from receiving prepayments

Losses are absorbed from the bottom up

After lockout period, if triggers are passed, subordination start to receive prepayments pro-rata

Mezzanines and subs receive scheduled principal payments & scheduled interest during lockout period

- (b) Your intern provides you with a summary of the company's counterparty exposure:
- Gross exposure is the absolute amount at risk and, thus, the worst case scenario
 - There is one contract that posted a letter of credit issued by the counterparty's parent as collateral, so we don't have any credit exposure to this counterparty.
 - We've provided a revolver to some of our borrowers in the auto industry but they've never used it, so we should adjust the exposure to reflect the actual historical usage.

Critique each of the above statements.

Commentary on Question:

Candidates performed below average on this part. Almost all candidates did not consider scenarios where the credit exposure could be dynamic or the concentration within an industry.

In long-term supply contracts of physical commodities and derivative contracts where the credit exposure is dynamic, gross exposure does not represent the worst case.

The collateral (letter of credit) can be considered worthless, since it is correlated with the underlying exposure.

In normal economic times, utilization of the revolver has been low and is not indicative of utilization during stressed times.

On top of that, there is concentration within an industry that could warrant further adjustments.

- (c) Describe the most commonly used methodology to assign a default probability to a counterparty.

Commentary on Question:

Candidates performed below average on this part. Most candidates considered using historical data but did not contemplate internal and external credit ratings.

Analyze a counterparty's financial strength and assign a rating to it that represents its perceived financial strength

For smaller companies, access financial data through companies' annual disclosures or by purchasing financials through a data vendor

Establish a hierarchy – internal ratings typically rank higher than external ratings.

Deal with inconsistencies – if external vendors have different views or split ratings, firms normally adopt a conservative posture and select the lowest indicator.

Map the internal ratings with external ratings, so historical data can be used appropriately

Use historical data to observe the historical default frequency of entities with similar ratings. The observed relative frequency is the estimate of the probability of default.

Consider the recovery rate or the net loss after recovery

Tenor of the transaction – long-term financial strength is harder to predict and the default probability increases with time

- (d) You are concerned about interest rates falling and enter into a 5-year, \$100M notional interest rate swap to manage the duration. The agreement specifies that you will pay a floating rate of SOFR + 100 bps per annum and the counterparty will pay you a fixed rate of 4%, with annual payments. At the end of the 3rd year, your counterparty goes bankrupt.

Your intern remarks that this simply means that the swap is terminated, there is no further settlement to consider, and we are lucky that we did not have any financial loss from this transaction.

Assess your intern's statement.

Commentary on Question:

Candidates performed above average on this part. Most candidates correctly identified that the intern's statements are incorrect but only provided one reason for why they are incorrect.

The statement is incorrect

If SOFR+100 was higher than the fixed rate at the time of bankruptcy, then a payment may be owed to the counterparty depending on the requirements of the swap contract

We are also subject to reinvestment risk, since we may not be able to enter into another contract with as favorable terms/conditions

16. QFI IRM Fall 2023, Question 3

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1 - 4

Commentary on Question:

Commentary is listed underneath each question component.

Solution:

(a) Compute the 97.5% VaR of L

Commentary on Question: *This question tests candidates' understanding of computing the loss distribution for an independent credit portfolio and the resulting VaR. Overall, candidates performed well in this question. Some candidates applied the normal approximation to compute the VaR, and no credits were given to such an approach.*

The loss distribution of the portfolio can be computed via

Case	Default	Loss	PMF	CDF
1	$\mathbb{I}_{\mathcal{D}_1}$ $= \mathbb{I}_{\mathcal{D}_2}$ $= 0$	0	$0.8 \cdot 0.9 = 0.72$	0.72
2	$\mathbb{I}_{\mathcal{D}_1} = 1, \mathbb{I}_{\mathcal{D}_2}$ $= 0$	10	$0.2 \cdot 0.9 = 0.18$	0.9
3	$\mathbb{I}_{\mathcal{D}_1} = 0, \mathbb{I}_{\mathcal{D}_2}$ $= 1$	20	$0.8 \cdot 0.1 = 0.08$	0.98
4	$\mathbb{I}_{\mathcal{D}_1} = 1, \mathbb{I}_{\mathcal{D}_2}$ $= 1$	30	$0.2 \cdot 0.1 = 0.02$	1

Thereby, $VaR_{97.5\%} = 20$ because the third case is the first time the CDF exceeds 0.95.

(b) Recalculate the 97.5% VaR of L , using the threshold model approach

Commentary on Question: This question mainly tests candidates' understanding of computing the loss distribution for a dependent credit portfolio constructed based on the threshold approach. Overall, candidates did not perform well in this question. Many candidates did not know how to compute the joint default probability under the threshold model.

Note that $d_1 = \Phi^{-1}(p_1) = -0.84162$ and $d_2 = \Phi^{-1}(p_2) = -1.28155$ are the default thresholds for the two assets. We have the following default probabilities:

- $P(\mathbb{I}_{\mathcal{D}_1} = \mathbb{I}_{\mathcal{D}_2} = 0) = P(y_1 > d_1, y_2 > d_2) = P(y_1 \leq -d_1, y_2 \leq -d_2) = 0.7515$
- $P(\mathbb{I}_{\mathcal{D}_1} = 1, \mathbb{I}_{\mathcal{D}_2} = 0) = P(y_1 \leq d_1, y_2 > d_2) = P(y_1 \leq d_1) - \Phi_2(d_1, d_2; \rho)$
- $P(\mathbb{I}_{\mathcal{D}_1} = 0, \mathbb{I}_{\mathcal{D}_2} = 1) = P(y_1 > d_1, y_2 \leq d_2) = P(y_2 \leq d_2) - \Phi_2(d_1, d_2; \rho)$
- $P(\mathbb{I}_{\mathcal{D}_1} = 1, \mathbb{I}_{\mathcal{D}_2} = 1) = P(y_1 \leq d_1, y_2 \leq d_2) = \Phi_2(d_1, d_2; \rho)$

Hence, the loss distribution of the portfolio can be computed via

Case	Default	Loss	PMF	CDF
1	$\mathbb{I}_{\mathcal{D}_1} = \mathbb{I}_{\mathcal{D}_2} = 0$	0	0.7515	0.7515
2	$\mathbb{I}_{\mathcal{D}_1} = 1, \mathbb{I}_{\mathcal{D}_2} = 0$	10	$0.2 - 0.0515 = 0.1485$	0.9
3	$\mathbb{I}_{\mathcal{D}_1} = 0, \mathbb{I}_{\mathcal{D}_2} = 1$	20	$0.1 - 0.0515 = 0.0485$	0.9485
4	$\mathbb{I}_{\mathcal{D}_1} = 1, \mathbb{I}_{\mathcal{D}_2} = 1$	30	0.0515	1

Finally, $VaR_{97.5\%} = 30$ because the fourth case is the first time the CDF exceeds 0.95.

- (c) Describe the difference between the VaR values based on the independence model and the threshold model.

Commentary on Question: *This question mainly tests candidates' understanding of the difference between independent model and threshold model, as well as how the induced dependence impacts the joint default probability. Overall, candidates performed well in this question. Most candidates could identify that the VaR under the threshold model is larger than that under the independence model, although the some candidates provided inappropriate reasoning.*

The VaR of the threshold model is greater than that of the independence model. This is because the threshold model assumes a positive dependence between the defaults of two bonds, thus the probability of both defaulting becomes higher in comparison with that of the independence model. This indicates that ignoring the positive dependence of default events may cause an under-estimation of the credit risk inherent in a portfolio.

17. QFI IRM Spring 2024, Question 4

Learning Outcome(s): 3c

Source Materials: Credit Risk Modeling, Bolder, 2018: Ch 1 - 4

Commentary on Question:

This question tests candidates' knowledge on evaluating and applying credit risks model. To receive full credit, candidates needed to provide support for their analysis.

Solution:

- (a) Describe two reasons why default events are not expected to be independent.

Commentary on Question:

Candidates performed well on identifying systematic risk as a reason but did not identify a second reason.

There may exist important industry interlinkages between specific credit obligors. Consider, for example, supply-chain relationships or competition. Poor performance could, therefore, lead to a deterioration or an improvement of other possible credit counterparts.

We should also expect shared regional or country risk exposures and, in the most general sense, common exposure to global economic conditions. If a particular region, country, or the entire planet faces difficult macroeconomic conditions, we should expect to observe correlation in degradation of creditworthiness and, ultimately default.

- (b) Calculate the probability of experiencing one or more defaults within the portfolio under the aforementioned binomial-mixture model.

Commentary on Question:

Candidates did not do well for this question. Most were not able to correctly identify the need for taking the expected value of Z^2 . Candidates received partial credits for identifying probability of one or more defaults as $1 - \text{probability of zero defaults}$.

First, the unconditional zero default probability can be calculated via

$$P(N = 0) = E[P(N = 0 | Z)] = E[Z^2] = \int_0^1 z^2 dz = 1/3.$$

Then the unconditional non-zero default probability is

$$P(N > 0) = 1 - P(N = 0) = 2/3 = 0.6667.$$

- (c) Calculate the covariance $Cov(\mathbb{I}_A, \mathbb{I}_B)$.

Commentary on Question:

Candidates had mixed performance on this question. Candidates received partial credits for identifying that the covariance equal to the variance of Z .

The unconditional covariance of default indicators under the binomial-mixtures model is computed via

$$\text{Cov}(\mathbb{I}_A, \mathbb{I}_B) = \text{Var}(P(\mathbb{I}_A = 1|Z)) = \text{Var}(Z) = 1/12.$$

- (d) Describe the difference between the probabilities of non-zero defaults obtained based on the independence and binomial-mixture models.

Commentary on Question:

Candidates did poorly on this question. Most candidates believed that the probabilities of non-zero defaults for binomial-mixture models were higher than independence because the probability of both companies defaulting is higher, but the probability of both companies not defaulting together is higher as well so the probability of overall non-zero defaults is lower.

The independence model yields a higher probability of non-zero defaults. This order is attributed to the positive dependencies observed among default events in the binomial-mixture model, as computed in question (b). Positive dependence implies that counterparties' default statuses are more likely to align. Consequently, the probability of non-zero defaults is higher under the independence model ($1-1/4=3/4$), in comparison with that under the binomial-mixture model ($1-1/3=2/3$).