

Level III of the CFA® Exam

Essay-Set Questions with Answers - Portfolio Management Pathway – Volume 1

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Case 29: Mr. Rashid Ibrahim

Rashid Ibrahim works in downtown Abu Dhabi, United Arab Emirates, managing a 500 million Dirham (DR) fixed-income portfolio. Ibrahim has worked at NeXT Level Capital Advisors for over 5 years and has recently been promoted to portfolio manager after a successful run as an analyst. His previous supervisor went on to be hired at a large NYC bank.

The portfolio duration is 9, the convexity is 0.00233, and Ibrahim expects a significant change in interest rates. The portfolio IPS allows him to vary the portfolio duration as he sees fit between 7 and 11. As his performance thus far has been excellent, the fund sponsors have given him discretion in managing the portfolio. Ibrahim schedules a meeting with his fixed-income analyst team.

The meeting began well, with the fixed income team all noting that their models agreed that interest rate volatility was rising. Some saw significant changes in volatility, while others saw slightly less severe swings.

“My models indicate that not only is volatility on the upswing, but that now might be the time get out ahead of the curve before a major global recession,” one analyst notes. “It seems that business activity has peaked, and most economies will be headed into a contraction stage from this point forward. It looks pretty grim, I'd say.”

“My expectations align perfectly with that analysis,” another says, adding that it might be the time to use the full range of their leeway permitted in the IPS and significantly change portfolio duration.

Another junior member of the team, Dhahran Sahania, who has just been promoted to an analyst, gathers the following information about the futures market for the portfolio's fixed-income investments:

UAE Government Debt (DR)
Term: 5 year
Par value: 100,000
BPV of CTD instrument: 80.101
The conversion factor of the CTD instrument: is 0.912
Credit Rating: AAA+

After the meeting, Ibrahim connects with his boss via video chat to discuss possible yield-curve strategies. Considering the team has strong notions about how interest rates may change in the future, Ibrahim wants to know what else he can do to increase the portfolio's yield, all while staying within the mandates of the IPS. Ibrahim says to his boss:

"I'm beginning to think further out into the future now. Let's say the yield curve flattens; what we would need in that environment would be a bullet portfolio to maintain the highest exposure possible to the desired maturities."

Ibrahim has been worried lately about some comments he has heard analysts making in the hallways about bond convexity and duration. He believes one of his analysts does not know how to calculate bond convexity, so he prepares a practice problem to test the analyst. Suppose the analyst can't use the following data to calculate the convexity of the Israeli government bond. In that case, Ibrahim plans to ask the analyst to attend continuing education classes during the evening.

Israeli Government Bond Data

Macaulay Duration: 10.5

Dispersion: 12

Cash flow yield: 2.34%

Convexity: ____

Q. 1 Assuming the models are correct, indicate whether Rashid and his team should *most likely* increase portfolio duration to the maximum of 11 or lower it to the minimum of 7. Explain your answer.

Increase to 11

With economic activity reaching a fever pitch, **a global contraction and subsequent recession would call for increasing portfolio duration.** This is because, in the **contraction phase, we expect interest rates to fall.** Since bond prices and interest rates have an inverse relationship, this means a portfolio with higher sensitivity to interest rate movements (higher duration) would outperform.

The reason for **falling interest rates** has to do with a **decrease in demand for loanable funds**, as economic prospects do not look bright for future investment and development, and many consumers cut back on their spending, further decreasing demand for loans and thus putting downward pressure on interest rates.

Q. 3 In response to Ibrahim's comment to his supervisor about portfolio structures during a flattening yield curve, choose the *most appropriate* strategy. Explain your response.

Barbell

In a flattening yield curve, **the barbell portfolio will have the highest exposure to longer-term maturities**, which will give it a **higher duration in the falling interest rate environment of the flattening yield curve and will account for higher bond price movements**.

The short-maturity range of the barbell structure **will add undesirable exposure to an increasing interest-rate environment during a flattening yield curve**. However, these maturities will have much lower durations and thus will not have as robust an effect as the exposure to long-term securities.

Q. 4 Calculate the convexity of the Israeli Government bonds.

The formula for convexity is:

$$\frac{\text{Macaulay Duration}^2 + \text{Macaulay duration} + \text{Dispersion}}{[1 + \text{Cash Flow Yield}]^2} = \frac{10.5^2 + 10.5 + 12}{[1.0234]^2} = 126.75$$

Macaulay duration = 10.5

Dispersion = 12

Cash flow yield = 2.34%

Case 18: Mr. Hiroku Namura

Hiroku Namura, a Tokyo-based fixed-income portfolio manager, is considering the following Japanese government bonds traded on the JBX (Japanese Bond Exchange):

Maturity (Years)	Coupon (%)	Yield	Price	Modified Duration	Convexity
3	5.98	0.48%	\$100.70	2.432	3.2
5	3.48	0.65%	\$101.99	5.231	20
7	2.73	1.20%	\$101.92	9.909	80.12

Namura is considering portfolio strategies based on various interest rate scenarios over the next 12 months. He is considering three long-only government bond portfolio alternatives, as follows:

Bullet: Invest solely in 5-year government bonds.

Equal weights: Invest equally in 3-year, 5-year, and 7-year bonds.

Barbell: Invest equally in 3-year and 7-year government bonds

Interest Rate Expectations:

Namura must use one of the previous strategies to complete the client's portfolio. Namura has been closely following the movements of the federal reserve and expects an accommodative interest rate policy. Namura believes that actual output has exceeded potential output and that the federal reserve will strike a more dovish tone in its next few policy meetings.

In addition to the abovementioned expectations, Namura has been troubled by the uncertainty of the interest rate environment over the past half-decade. Namura not only hopes but reasonably expects, based on his thorough research, that this trend will reverse course. Namura believes that a dovish fed will help bring about these circumstances, coupled with the current phase of the economic cycle, which he believes to be near peak expansion.

Q. 1 Calculate the modified duration of the barbell portfolio. Show your calculations.

The modified duration of a fixed-income portfolio is approximately equal to the market value-weighted average of the bonds in the portfolio. Therefore, the barbell has a modified duration of:

$$\frac{3 \text{ year bond} + 7 \text{ year bond}}{2} = \frac{2.432 + 9.909}{2} = 6.17$$

Q. 2 Calculate the modified duration of the equally weighted portfolio. Show your calculations.

The modified duration of a fixed-income portfolio is approximately equal to the market value-weighted average of the bonds in the portfolio. The equally weighted portfolio has a modified duration of:

$$\frac{3 \text{ year bond} + 5 \text{ year bond} + 7 \text{ year bond}}{3} = \frac{2.432 + 5.231 + 9.909}{3} = 5.86$$

Q. 3 Choose the optimal portfolio alternative based on Namura's interest rate expectations. Briefly justify your answer.

Barbell portfolio

Namura's **expectations are for falling interest rates**. Bond prices will **rise when interest rates fall**, and those with the highest durations will rise the fastest. Namura should choose the portfolio **with the highest modified duration**.

Barbell	6.17
Bullet	5.23
Equal weight	5.86

Q. 4 State whether Namura should buy or sell convexity in his portfolio, given his interest rate volatility expectations. Justify with reasons.

Sell

Namura expects **interest rate volatility to decrease**. Since convexity can be considered insurance or protection against large interest rate movements (much like owning a put option), Namura could **sell off his portfolio convexity and earn a higher return**. If his expectations are realized, **the added convexity will not be needed in a calm environment of slowly lowering rates**.

Q. 5 Namura is concerned about a recent conversation with one of the interns on his trading desk. During lunch, Namura remembers the intern making the following statements about portfolio convexity: **Statement 1:** Portfolio convexity is a second-order effect that causes the value of a portfolio to respond to a change in interest rates in a non-linear manner. **Statement 2:** Convexity results in a greater increase in price for a decline in interest rates and a greater decrease in price when interest rates rise. Indicate whether you agree or disagree with each statement made by the intern. If you disagree, justify your position.

Statement 1 is true. Portfolio convexity is a second-order effect that causes the value of a portfolio to respond to a change in interest rates in a non-linear manner."

Statement 2 is false. Convexity results in a greater increase in price for a decline in interest rates and a greater decrease in price when interest rates rise." **Convexity will reduce the negative impact of an increase in interest rates, resulting in a lesser decrease in price when interest rates rise.**

Q. 6 Namura is even more concerned about the intern's comments about convexity. He decides to raise the issue with his supervisor. Using his Eidetic memory, Namura does his best to recall the intern's comments. The supervisor responds by stating: **Statement 3:** Convexity results in a larger increase in price for an increase in interest rates and a lesser decrease in price when interest rates fall. **Statement 4:** Convexity results in a larger increase in price for a decline in interest rates and a lesser decrease in price when interest rates rise. Indicate whether you agree or disagree with each statement made by the supervisor. If you disagree, justify your position.

Statement 3 is false. Convexity results in a larger increase in price for an increase in interest rates and a lesser decrease in price when interest rates fall."

Interest rates and bond prices are inversely related, and

Statement 4 is true. Convexity results in a larger increase in price for a decline in interest rates and a lesser decrease in price when interest rates rise."

Case 1: Mrs. Janice Marillo

Janice Marillo is a Philippines-based equity portfolio manager. Marillo has been working with existing portfolios for clients and attempting to add value by adding some enhancements without changing the asset allocation too much. For this service, Marillo charges 1% of the incremental annual returns on top of the client's current fees. Marillo arrived at her office early in the morning and is analyzing a potential long extension for a new client.

Q. 1 Describe a “long-extension portfolio.” State two benefits of a long-extension strategy.

A long-extension portfolio **combines long and short positions, which must equal 100% of the total capital invested when combined.** The short positions fund the excess long positions, resulting in gross leverage.

Benefits include:

1. Potential for **greater alpha and more efficient exposure to rewarded factors.**
2. The long/short approach allows the **portfolio to benefit from insights on companies forecasted to perform well and from insights on companies forecasted to perform poorly.**
3. The strength of the positive and negative views can **be expressed more symmetrically**, not just limited by a potentially small allocation of stock in a benchmark.

Q. 2

Portfolio	Long Exposure	Short Exposure	Cash
Bennet- Long Only	100	0	0
Friedman - 130/30 long extension	130	30	0
Halverson - 150/50 long extension	150	50	0
Alban - Market neutral - low risk	50	50	100
Harold - Market neutral - higher risk	100	100	100
Marcus - Directional - low risk	80	40	60
Diamond - Net short	40	100	160

Calculate the gross exposure for the Friedman Portfolio.

$$\begin{aligned}\text{Gross exposure} &= \text{Long exposure} + |\text{Short exposure}| \\ &= 130 + |30| = 160\end{aligned}$$

Q. 3 Calculate the net exposure for the Halverson Portfolio.

$$\begin{aligned}\text{Net exposure} &= |\text{Long exposure}| - |\text{Short exposure}| \\ &= |150| - |50| = 100\end{aligned}$$

Long-extension portfolios balance 100% of the invested capital by definition.

Q. 4 Marillo meets with a colleague for dinner, and the conversation turns to Marillo's latest offering set of projects, and the two begin to discuss long-only investing. Marillo states: **Statement 1:** Portfolio construction can be framed as an optimization problem using an objective function and a set of constraints. The objective function of a systematic manager will be specified implicitly, whereas that of a discretionary manager may be set explicitly.. **Statement 2:** Common stocks provide investors with unlimited Liability. The lowest a stock price can fall to is zero, so the maximum amount that a long-only investor in common stock can lose is the amount of money initially invested in the firm. This is a commonly cited merit of long-only investing. Indicate whether you agree or disagree with the statements made by Marillo during dinner with her colleague. If you disagree, justify your position.

Statement 1 is false. Portfolio construction can be framed as an **optimization problem using an objective function and a set of constraints**. The objective function of a systematic manager will be **specified implicitly**, whereas that of a **discretionary manager may be set explicitly**." Systematic managers use **explicit objective functions**, and discretionary managers use **implicit functions**.

Statement 2 is false. Common stocks provide investors with unlimited Liability. The lowest a stock price can fall to is zero, so the **maximum amount that a long-only investor in a common stock can lose is the amount of money initially invested in the firm**. This is a commonly cited merit of **long-only investing**." Stocks provide investors with **LIMITED Liability, not Unlimited Liability**.

Q. 5 Marillo and her colleague continue their conversation over dinner. Marillo's colleague makes the following statements about market-neutral portfolios: **Statement 3:** In market-neutral portfolios, the dollars invested in long securities equal the dollars invested in short-selling—that is, a portfolio with zero net investment, also known as “dollar neutral.” **Statement 4:** Statistical arbitrage uses statistical techniques to identify two investments that are historically highly uncorrelated with each other. When the price correlation of these two securities deviates from its long-term average, the manager will go long the underperforming stock and simultaneously short the outperforming stock. Indicate whether you agree or disagree with the statements made by Marillo's colleague during dinner. If you disagree, justify your position.

Statement 3 is false. In market-neutral portfolios, the dollars invested in long securities equal the dollars invested in short-selling—a portfolio with zero net investment, also known as “dollar neutral.” Dollar neutrality is not the same as market-neutral because the economic drivers of returns for the long side may not be the same as the economic drivers for the short side. Actual market-neutral strategies seek to hedge out most market risks.

Statement 4 is false. Statistical arbitrage uses statistical techniques to identify two investments that are historically highly uncorrelated with each other. When the price correlation of these two securities deviates from its long-term average, the manager will go long the underperforming stock and simultaneously short the outperforming stock.” The two securities must be highly correlated with each other, not uncorrelated. This temporary breakdown of the historical relationship allows profit when regression to the mean occurs.

Q. 6 Marillo's colleague shows some hesitation at the idea of creating portfolios that involve a component of short selling. Marillo is discouraged because she believes she has coherently explained the benefits of short selling. Marillo's colleague can't concretely communicate his distaste for short-selling but makes a few vague statements such as "I wouldn't ever want to be involved in short-selling" or "it's just not for me, you know?" State two reasons why an investor may be ideologically opposed to short selling.

Some investors may:

1. Feel that **gaining** from the **losses** of others is **morally wrong**.
2. Believe that **short-selling** requires significantly **greater expertise** compared to long-only investing, and such knowledge is not reliably available.
3. Argue that **short selling** requires **leverage**, and they may be **unwilling to assume this risk**.

Case 2: Mrs. Cassidy Rai

Cassidy Rai is a consultant tasked with evaluating suitable candidates to manage the equity portion of Right Now Foundation, established 25 years ago to provide grants to local college students based on their financial needs. Cassidy has gathered data on two top-quartile managers, one in the US large-cap value category and the other in the US large-cap growth category.

	Princeton Value Funds	Lunar Growth Funds
Benchmark	Russell 1000 Value	Russell 1000 Growth
R ²	73%	63%
Average return	7.10%	10.40%
Active share	0.97	0.87
Active risk	5.40%	12.10%

Cassidy analyzes data on the two asset managers' rolling three-year monthly Sharpe-style weights for the last five years. The table below provides the results of her analysis.

Fund	Style Index	Year 1	Year 2	Year 3	Year 4	Year 5
Princeton	Russell 1000 Value	98%	99%	97%	97%	98%
	Russell 1000 Growth	0%	0%	1%	2%	1%
	Russell 2000 Value	2%	1%	2%	0%	1%
	Russell 2000 Growth	0%	0%	0%	1%	0%
Lunar	Russell 1000 Value	4%	10%	12%	17%	21%
	Russell 1000 Growth	91%	86%	78%	71%	65%
	Russell 2000 Value	1%	0%	4%	5%	4%
	Russell 2000 Growth	4%	4%	6%	7%	10%

Note that the Russell 1000 is large-cap, while the Russell 2000 is small-cap.

Q. 1 Determine whether the two managers being analyzed by Cassidy were actively managed during the last 5 years and discuss if they have active security and sector bets. Justify your response with two reasons for each.

Determine whether actively managed or not	Justify your response with two reasons for each
Princeton Value Funds Yes	A high active share indicates that the fund is being actively managed and has significant weight divergences in securities from the benchmark. The low active risk indicates a low sector weight divergence vs. the benchmark.
Lunar Growth Funds Yes	A high active share indicates that the fund is being actively managed and has significant weight divergences in securities from the benchmark. The high active risk indicates that the manager is taking active sector bets vs. the benchmark.

Q. 2 Determine whether the two managers have witnessed significant style drift over the last 5 years. Justify your response.

Determine whether experienced significant style drift. (Yes or No)	Justify your response
Princeton Value Funds NO	Princeton Value did not experience significant style drift since its Sharpe style weight was consistently at or above 97% on the Russell 1000 Value Index. Variations in Sharpe style weights across other style indices were also consistently low during the period.
Lunar Growth Funds YES	Lunar Growth Fund has witnessed significant style drift over the last five years which is evident from its Sharpe style weight on Russell 1000 Growth Fund which has declined from 91% to 65% over the period. The style has leaned more towards Large-cap value as evidenced by increased weight on Russell 1000 Value. He has also drifted a little towards small-cap as evidence in increase towards weighting to both Russell 2000 Value and Growth indices.

Q. 3 Later in the day, Cassidy meets another client, Medi Foundation, which provides grants to regional hospitals to treat people who cannot bear healthcare expenses. The foundation operates in a jurisdiction where foundations are not exempt from taxes on interest income, dividend income, and capital gains. The foundation wants to allocate US\$ 10 million to equities through a separately managed portfolio. The investment committee of Medi strongly believes that a tracking risk below 1% is most suitable for the foundation's equity portfolio and is even willing to accept a low information ratio as long as returns are sufficient to maintain targeted spending. The investment committee believes that the country's equity markets are inefficient. However, the committee expects a decline in interest rates in the future. The committee prefers not to use complicated statistical models and firmly believes that the portfolio is invested in only US blue-chip stocks. Based on the investment committee's objectives, Cassidy suggests using a passive investment approach with S&P 500 as the benchmark. Identify the most appropriate approach to constructing the equity portfolio of Medi Foundation. Support your response with two reasons.

Full replication	Full replication Supporting arguments: • The investment committee believes a tracking risk below 1% is most suitable and is even willing to accept a low information ratio as long as returns are sufficient to maintain targeted spending. • Transaction costs associated with blue-chip stocks that comprise S&P 500 are very low. • The committee prefers not to use complicated statistical models.
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Case 22: Global Horizon Fund

Global Horizon Fund (GHF) is an investment fund focused on international fixed-income securities. GHF's primary objective is to maximize total return from the bond markets while managing the risks associated with changes in interest rates and yield curve shifts. The investment team believes that the current environment poses significant challenges and opportunities for the fund's portfolio, which is diversified across various maturities and credit qualities.

The risk management team at GHF is mainly concerned with the fund's exposure to yield curve risk. Recent market developments suggest a non-parallel yield curve shift could occur within the next quarter. The fund's current bond holdings are primarily in government securities with varying maturities. GHF's portfolio is also exposed to interest rate swaps, which the team has strategically used to adjust the fund's duration and convexity.

As the Chief Investment Officer (CIO) of GHF, you are tasked with analyzing the potential yield curve shifts and implementing strategies to optimize the portfolio returns. You anticipate potential parallel shifts, steepening/flattening of the curve, and changes in interest rate volatility. To mitigate risks and capitalize on yield curve shifts, you must consider adjustments to the fund's portfolio positioning and the use of derivatives such as interest rate futures and interest rate swaps.

Given this background, you are examining the fund's sensitivity to crucial rate durations and contemplating adopting a barbell or bullet portfolio structure to adjust convexity without significantly altering the portfolio's duration. The current yield curve indicates a moderate convexity level with long-term rates at historic lows and short-term rates expected to rise due to central bank tightening.