

LM10 • FIXED INCOME • CFA LEVEL I

Interest Rate Risk and Return

Sources of return on fixed-rate bonds; horizon yield; Macaulay duration as the offset point; and the duration gap.

Learning Outcomes

LOS a Calculate and interpret sources of return from investing in a fixed-rate bond

LOS b Describe the relationships among a bond's investment horizon, holding period, and interest rate risk

LOS A • THREE SOURCES OF BOND RETURN

Three Sources of Return — Bond Purchased at Par

- 1 **Receipt of the promised coupon and principal payments.**
- 2 **Reinvestment of coupon payments** (at prevailing reinvestment rates).
- 3 **Potential capital gain (or loss)** on the sale of the bond prior to maturity.

If a bond is purchased at a **discount** or **premium**, the rate of return also includes the effect of the price being "**pulled to par**" as maturity approaches.

$$Total\ return = reinvested\ coupon\ interest + sale/redemption\ proceeds$$

LOS B • TWO DIRECTIONS OF IR RISK

Two Channels of Interest Rate Risk

Market price risk

Bond prices are **inversely proportional** to interest-rate movements. Prices decrease when rates rise. Dominant for investors with **short horizons**.

Coupon reinvestment risk

The value of reinvested coupons is **directly proportional** to interest rates. Higher rates → more reinvestment income. Dominant for investors with **long horizons** (e.g., buy-and-hold).

The two risks offset! A rate rise hurts current price (loss) but helps future reinvestment (gain); a rate drop does the opposite. The offset point is governed by Macaulay duration.

LOS B • THE OFFSET POINT

Macaulay Duration as the Investment Horizon

Macaulay duration can be interpreted as the **investment horizon at which coupon reinvestment risk and market price risk offset** each other.

Macaulay duration = weighted average time to receipt of coupon interest and principal payments

CONDITION	DURATION GAP	WHICH RISK DOMINATES	DIRECTION OF RATE RISK
Horizon > Mac dur	Negative	Coupon reinvestment risk	Risk of lower rates
Horizon = Mac dur	Zero	Offsetting — immunized	Neutral (parallel shift)
Horizon < Mac dur	Positive	Market price risk	Risk of higher rates

WORKED EXAMPLE • RETIREE'S DURATION GAP

Worked Example — Duration Gap

EXAMPLE

Retirement planner — 10-year 6% annual bond

GIVEN

- Investor plans to retire in **8 years**.
- Newly issued **10-year, 6% annual coupon** bond.
- Purchased at par; YTM = 6% (EAR).
- Bond's Macaulay duration = **7.8016**.

FIND

(1) Duration gap at time of purchase. (2) Does this bond at purchase entail the risk of higher or lower rates?

SOLUTION (1)

$$Duration_{gap} = Macdur - Horizon = 7.8016 - 8 = -0.1984$$

Negative duration gap.

SOLUTION (2)

A **negative duration gap** entails the risk of **lower interest rates**: the loss from reinvesting coupons at a rate lower than 6% would exceed the gain from selling the bond at a price above its constant-yield price trajectory.

ANSWER

Duration gap = **-0.1984**; the bond is exposed to **falling rates** (coupon reinvestment risk dominates).

CHECKPOINT 1

Quiz 1: Sources & Horizon

Answer all questions to test your understanding. Your score updates on the final step.

Q1. The three sources of return from investing in a fixed-rate bond purchased at par are:

Q2. For an investor with a short investment horizon, the *dominant* interest rate risk is:

Q3. The Macaulay duration of a bond is *most accurately*:

Q4. If an investor's horizon equals the bond's Macaulay duration, the duration gap is:

Q5. Using the curriculum example (10y 6% bond, Mac dur 7.8016, 8-yr horizon), the duration gap is:

SUPPLEMENTAL · PULL TO PAR

Pull-to-Par Effect (Discount and Premium Bonds)

Premium bond

Priced above par at purchase. As maturity approaches and the bond's YTM remains constant, the price drifts **down** toward par — a built-in capital loss.

Discount bond

Priced below par at purchase. As maturity approaches and YTM stays constant, the price drifts **up** toward par — a built-in capital gain.

If YTM stays unchanged, the realized return of an HTM investor equals the initial YTM. If rates move, reinvestment + price risk determine the realized yield relative to expected YTM.

INTEGRATION · HORIZON YIELD & IMMUNIZATION

Horizon Yield

The **horizon yield** is the realized yield an investor earns over a holding period shorter than maturity. It depends on reinvestment rates and the sale price at the horizon date.

$$\text{Total ending value} = \text{FV of reinvested coupons} + \text{sale price at horizon} \quad \text{Horizon yield} = (\text{Total} / \text{Pr}$$

Immunitization: If an investor chooses a bond whose **Macaulay duration equals the horizon**, the horizon yield approximately equals the initial YTM regardless of a one-time parallel yield-curve shift — this is classical single-horizon immunization.

CHECKPOINT 2

Quiz 2: Duration Gap Mechanics

Answer all questions to test your understanding. Your score updates on the final step.

Q6. An investor with a 15-year horizon who buys a bond with Mac duration of 7 years has a duration gap of:

Q7. An investor planning to sell a bond in 2 years buys a bond with Macaulay duration of 9 years. The *dominant* interest-rate risk is:

Q8. A premium bond's expected capital path over time, holding YTM constant, is:

Q9. A duration gap of *zero* at a single parallel rate shift implies the horizon yield is:

Q10. Which investor is *most likely* to be hurt by falling interest rates?

REVIEW · DURATION GAP CHEAT SHEET

Duration Gap Decision Grid

SCENARIO	DURATION GAP	HURTS WHEN RATES...	WHY
Short horizon investor, long-dur bond	Positive	Rise	Price loss > reinvestment gain
Long horizon investor, short-dur bond	Negative	Fall	Reinvestment loss > price gain
Horizon = Mac dur	Zero	(neutral)	Risks offset; approximately immunized

CHECKPOINT 3 · SYNTHESIS

Quiz 3: Synthesis

Answer all questions to test your understanding. Your score updates on the final step.

Q11. Coupon reinvestment risk is *most consequential* for an investor who:

Q12. If a bond is held until maturity (ignoring default), its return is *most accurately*:

Q13. Premium bonds experience a "pull-to-par" *price path* characterized by:

Q14. An investor holding a bond with duration gap near zero is *most likely*:

Q15. For two bonds with the same YTM and maturity, the bond with the *lower* Macaulay duration is *most likely* the one with:

MODULE COMPLETE

Your Scorecard

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LM10 Key Takeaways — Exam-Ready Cheat Sheet

Sources of return

Coupon + reinvestment of coupons + capital gain/loss (incl. pull-to-par for discount/premium).

Two risks of IR

Market price risk — dominant at short horizons. **Coupon reinvestment risk** — dominant at long horizons. They offset at Macaulay duration.

Duration gap

Dur gap = Mac dur – horizon. Positive → price risk dominates, risk of rising rates. Negative → reinvestment dominates, risk of falling rates. Zero → immunized.

Curriculum example: 10y 6% par bond, Mac dur 7.8016, 8-year horizon → dur gap = -0.1984 ; risk of **lower** rates.