Fixed-Income Portfolio Management

CFA三级培训项目

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101% Contribution Breeds Professionalism

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Topic in CFA Level III

Session	Content
Study Session 1-2	ETHICS & PROFESSIONAL STANDARDS (1)&(2)
Study Session 3	BEHAVIORAL FINANCE
Study Session 4	CAPITAL MARKET EXPECTATIONS
Study Session 5	ASSET ALLOCATION AND RELATED DECISIONS IN PORTFOLIO MANAGEMENT
Study Session 6	DERIVATIVES AND CURRENCY MANAGEMENT
Study Session 7-8	**FIXED-INCOME PORTFOLIO MANAGEMENT (1)&(2)**
Study Session 9-10	EQUITY PORTFOLIO MANAGEMENT (1)&(2)
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Study Session 15	TRADING, PERFORMANCE EVALUATION, AND MANAGER SELECTION
Study Session 16	CASES IN PORTFOLIO MANAGEMENT AND RISK MANAGEMENT

Framework

Fixed-income Portfolio Management

- **SS7 Fixed-income Portfolio Management (1)**
  - R18 Overview of Fixed-Income Portfolio Management
  - R19 Liability-Driven and Index-Based Strategies
- **SS8 Fixed-income Portfolio Management (2)**
  - R20 Yield Curve Strategies
  - R21 Fixed-Income Active Management: Credit strategies

Overview of Fixed-Income Portfolio Management

Framework

1. Roles of fixed-income in portfolios
   - Diversification benefit
   - Benefits of regular cash flows
   - Inflation hedging potential
2. Fixed-income mandates
   - Liability-based mandates
   - Total return mandates
3. Bond market liquidity
   - Liquidity among bond market
   - Effect of liquidity on portfolio

Framework

4. Model for fixed-income returns
   - Decomposing expected returns
5. Leverage
   - Using leverage
   - Methods for leveraging portfolios
   - Risks of leverage
6. Fixed-income portfolio taxation
   - Principles of taxation
   - Investment vehicles and taxes

1. Roles of fixed-income in portfolios

- Fixed-income investments can provide ***diversification benefits*** when combined with other asset classes.
  - Correlation coefficient <1, but difficult to find assets much lower than 1.0.
  - Correlation coefficient (ρ) between indexes:
    - ✓ ρ between US bond market's investment grade sub-sector=0.77~0.95 (highly correlated).
    - ✓ ρ between **international investment-grade bonds and US investment-grade bond=0.54** (significant diversification benefits existed for including both US and non-US bonds).

Roles of fixed-income in portfolios

- Fixed-income investments can provide ***diversification benefits*** when combined with other asset classes.
  - ρ is not constant.
    - ✓ Market stress period
      - → decrease between government and equity
      - → increase between high yield bond and equity
  - Bonds: less volatile than equity
    - ✓ Interest rate volatility increases
      - →near-term volatility>average volatility

Roles of fixed-income in portfolios

- Fixed-income investments typically produce ***regular cash flows*** to a portfolio.
  - Meet the future obligations:
    - ✓ Tuition payments
    - ✓ Pension obligations
    - ✓ Payout on life insurance policies
  - Approach: **ladder bond portfolio** by staggering the maturity dates of portfolio bonds through investment horizon.
    - ✓ Balance price risk and reinvestment risk

Roles of fixed-income in portfolios

- Some fixed-income securities can provide a ***hedge for inflation***.
  - $R_{nominal} = R_{real}$ + Inflation rate
  - Protection against inflation

	Coupon	**Principal**
Fixed-coupon bonds	Unprotected	Unprotected
Floating-coupon bonds	Protected	Unprotected
Inflation-linked bonds	Protected	Protected

2. Fixed-income mandates

- Fixed-income mandates can be broadly classified into ***liability-based mandates*** and ***total return mandates***.
  - Liability-based mandates are also referred to as
    - ✓ Structured mandates
    - ✓ Asset/liability management (ALM)
    - ✓ Liability-driven investments (LDI)
  - Total return mandates are generally managed in an attempt to either track or outperform a market-weighted fixed-income benchmark.
    - ✓ Achieve the highest risk-adjusted returns
  - The two types of mandates have fundamentally different objectives.

2.1 Liability-based mandates

- Users of liability-based mandates:
  - Individual: funding cash flow & life style needs
  - Institution: bank, insurance company, pension funds
- There are 2 main approaches to liability-based mandates: ***cash flow matching & duration matching.***
- **Duration matching - Immunization:**
  - An ALM approach.
  - To minimize the variance in the realized rate of return over a known time horizon.
  - Reduce or eliminate the risk associated with a change in market interest rates.

2.1 Liability-based mandates

➢ **Liability-based mandates: key features**

	Duration match	Cash flow match
Yield curve assumption	Parallel yield curve shifts	None
Mechanism	Risk of shortfall in cash flows is minimized by matching duration and present value of liability stream	Bond portfolio cash flows match liabilities
Basic principle	Cash flows come from coupon and principal repayments of the bond portfolio and offset liability cash flows	Cash flow, coupon and principal repayments of the bond portfolio offset liability cash flows
Rebalancing	Frequent rebalancing required	No required but often desirable
Complexity	High	Low

2.1 Liability-based mandates

- **Contingent immunization**
  - When “value of asset portfolio” > “present value of liability” →surplus→allowed to actively manage the asset portfolio
  - When actively managed portfolio < specified threshold→active management ceases
- **Horizon matching**
  - Cash flow matching (short-term liability, <=4-5 years) + duration matching (long-term liability)

Example

- An investor is looking to immunize a single liability, but is concerned with the impact from yield curve shifts and twists. When attempting to immunize this liability, which of the following rules should the investor apply?
  A. The portfolio Macaulay duration should match the due date of the liability.
  B. The dispersion of asset cash flows around the liability should be maximized.
  C. The present value of liabilities should exceed the initial portfolio market value.

Example

- **Correct Answer: A.**
  - Rules for immunizing a single liability include the following:
    - ✓ Initial portfolio market value (PVA) equals (or exceeds) PVL.
    - ✓ Portfolio Macaulay duration matches the due date of the liability ($D_A = D_L$).
    - ✓ Minimize portfolio convexityi(to minimize dispersion of asset cash flows around the liability and reduce risk to curve reshaping).

Example

- Which of the following statements correctly describes contingent immunization?
  - A. It uses Treasury futures contracts to adjust the portfolio and maintain duration matching.
  - B. It constructs a portfolio of zero-coupon bonds that provide enough cash inflows to meet liabilities.
  - C. It uses active bond portfolio management, as long as the present value of assets exceeds the present value of liabilities.

Example

- **Correct Answer: C.**
  - Contingent immunization is a hybrid active/passive strategy. It requires initially overfunding the portfolio with more assets than needed to immunize and meet the future liability.
  - As long as that surplus is of sufficient size, the portfolio can be actively managed. A derivatives overlay uses Treasury futures contracts to adjust the portfolio. Cash flow matching creates a portfolio of zero-coupon bonds to match cash inflows with cash outflows.

Overview of Classic Immunization

补充

- **Risk when interest rates change**
  - Reinvestment risk;
  - Interest rate or price risk.
- **Assumption**
  - Parallel shift in the yield curve (i.e. all yields rise and fall uniformly).

Classic Immunization

补充

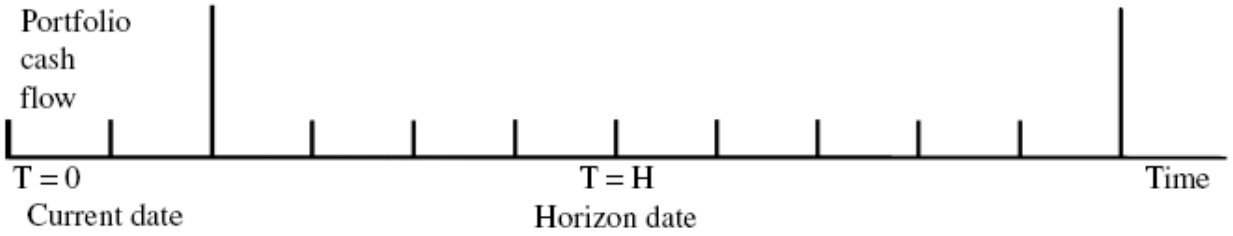
- **Immunization of a single obligation**
  - Select a bond or a bond portfolio with an effective duration equal to the duration of the liability;
  - Set the PV of the bond or the portfolio equal to the PV of the liability.
- **If the duration not equal to**
  - If portfolio duration < liability duration, the portfolio is exposed to reinvestment risk;
  - If portfolio duration > liability duration, the portfolio is exposed to price risk.
- **Immunization cease when**
  - Interest rates fluctuate more than once;
  - Time passes.
- **Immunization risk**
  - Arbitrary (Non-parallel) changes in interest rates.

Immunization risk

补充

- **Using zero-coupon bond → no immunization risk**

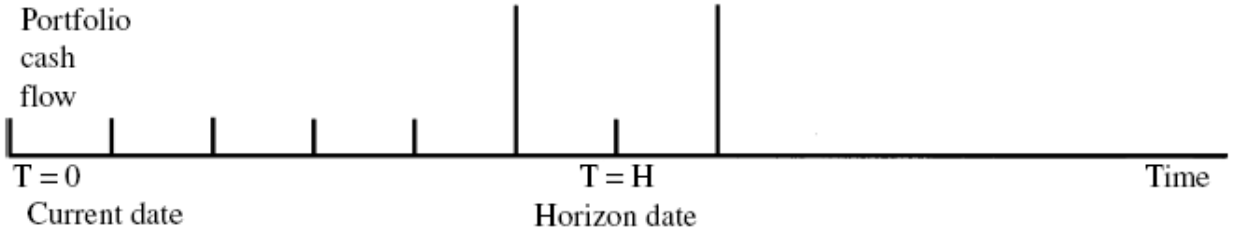
Portfolio A: High-risk immunized portfolio:



Note: Portfolio duration matches horizon length. Portfolio's cash flow dispersed.

Barbell strategy

Portfolio B: Low-risk immunized portfolio:



Portfolio duration matches horizon length. Portfolio's cash flow concentrated around horizon dates.

Bullet Strategy

Convexity作用类似于option

$$\text{convexity} = \frac{\text{Mac. Duration}^2 + \text{Mac. Duration} + \text{Dispersion}}{(1 + \text{cash flow yield})^2}$$

Multiple Liabilities Immunization

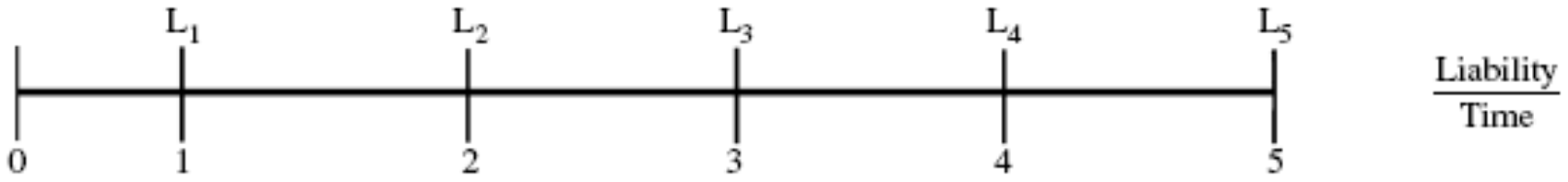
补充

- **The key to immunizing multiple liabilities …**
  - Decompose the portfolio payment streams separately immunize each of the multiple liabilities
- **The following conditions should be satisfied …**
  - Parallel rate shift
  - Asset and liability have the same PV
  - Asset and liability have the same aggregate durations
  - The range of the distribution of durations of individual assets in the portfolio must exceed the distribution of liabilities

Cash Flow Matching

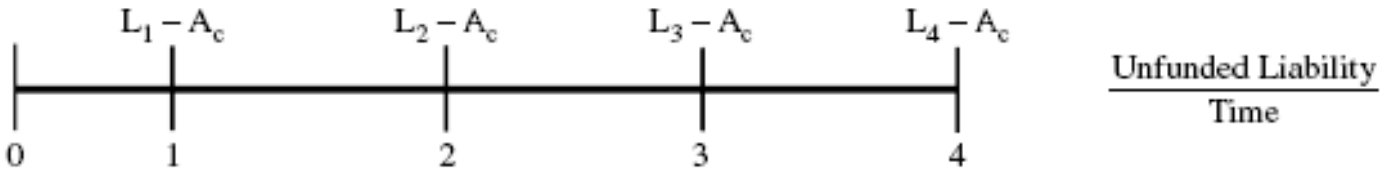
补充

Assume: 5-year liability stream
Cash flow from bonds are annual.



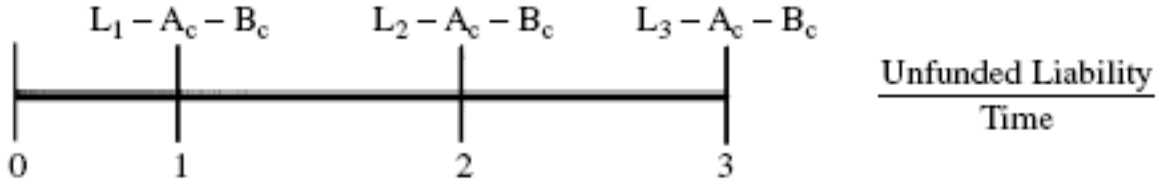
Step 1

Cash flow from Bond A selected to satisfy L_5
Coupons = A_c; Principal = A_p and $A_c + A_p = L_5$
Unfunded liabilities remaining:



Step 2

Cash flow from Bond B selected to satisfy L_4
Unfunded liability = $L_4 - A_c$
Coupons = B_c; Principal = B_p and $B_c + B_p = L_4 - A_c$
Unfunded liabilities remaining:



Cash Flow Matching

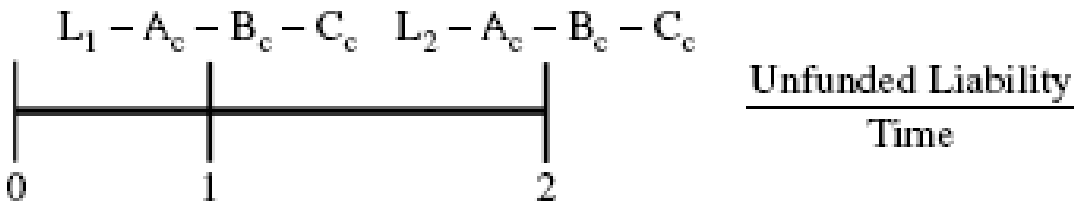
补充

Step 3 Cash flow from Bond C selected to satisfy L_3

Unfunded liability $= L_3 - A_c - B_c$

Coupons $= C_c$; Principal $= C_p$ and $C_c + C_p = L_3 - A_c - B_c$

Unfunded liabilities remaining:

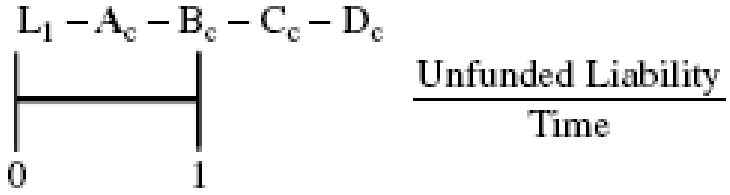


Step 4 Cash flow from Bond D selected to satisfy L_2

Unfunded liability $= L_4 - A_c - B_c - C_c$

Coupons $= D_c$; Principal $= D_p$ and $D_c + D_p = L_2 - A_c - B_c - C_c$

Unfunded liabilities remaining:

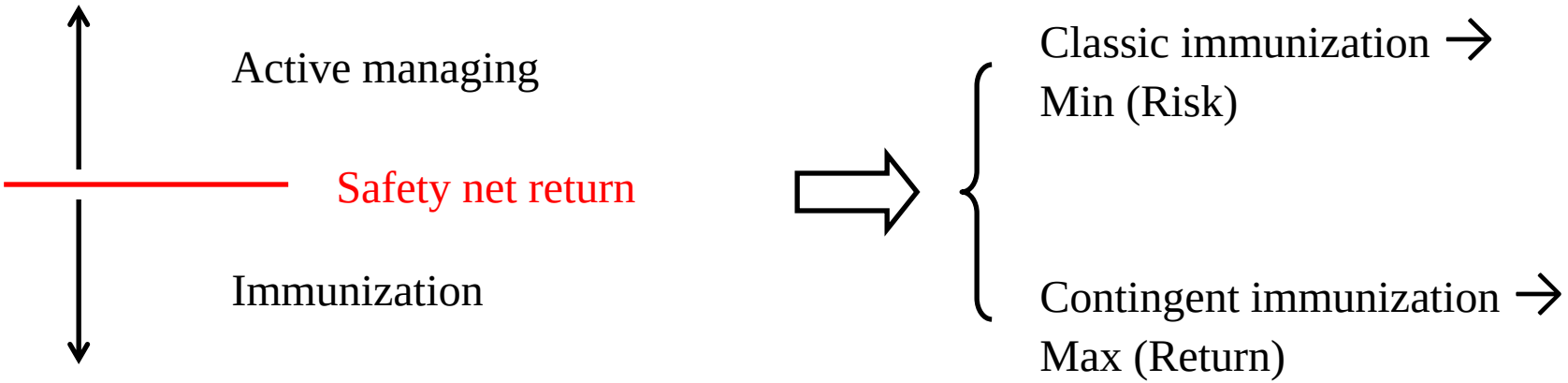


Step 5 Select Bond E with a cash flow of $L_1 - A_c - B_c - C_c - D_c$

Contingent Immunization

补充

- **Key considerations …**
  - Establishing well defined immunized initial and ongoing available target returns
  - Identifying a suitable and immunizable safety net return
  - Implementing an effective monitoring procedure to ensure that the safety net return is not violated
- **Understanding the contingent immunization …**



Contingent Immunization

补充

- **The frequency of rebalancing …**
  - The difference between the safety net return and current market interest rate
  - Low safety net return → infrequent rebalance
  - High safety net return → little opportunity for active management
- **Two factors cause effective monitoring fail …**
  - Adverse movements too quickly
  - The lack of assurance that the immunization rate will be achieved

2.2 Total return mandates

- **Total return approach: key features**

	Pure indexing	Enhanced indexing	Active management
Objective	Match benchmark return and risk as closely as possible	Modest performance (20-30bp) of benchmark while active risk is kept low (around 50bp or lower)	Higher outperformance (50bp or more) of benchmark and higher active risk levels
Portfolio weights	Same as benchmark or only slight mismatches	Small deviations from underlying benchmark	Significant deviations from underlying benchmark
Risk	Risk factors are matched exactly	Most primary risk factors are closely matched (duration)	Deviations from benchmark (duration)
Turnover	Similar to underlying benchmark	Slightly higher than underlying benchmark	Considerably higher turnover than the underlying benchmark

Example

- A fixed-income portfolio manager is seeking to outperform the Barclays Capital Aggregate Bond Index. Which of the following statements most accurately describes a pure indexing strategy for achieving the total-return mandate? Pure bond indexing:

  A. allows large deviations from the risk factors of the index and seeks a high active return.

  B. matches duration to the index, but some risk mismatches of sectors and quality are allowed.

  C. seeks to exactly match all the risk factors of the index while allowing the manager some leeway on the individual bonds selected.

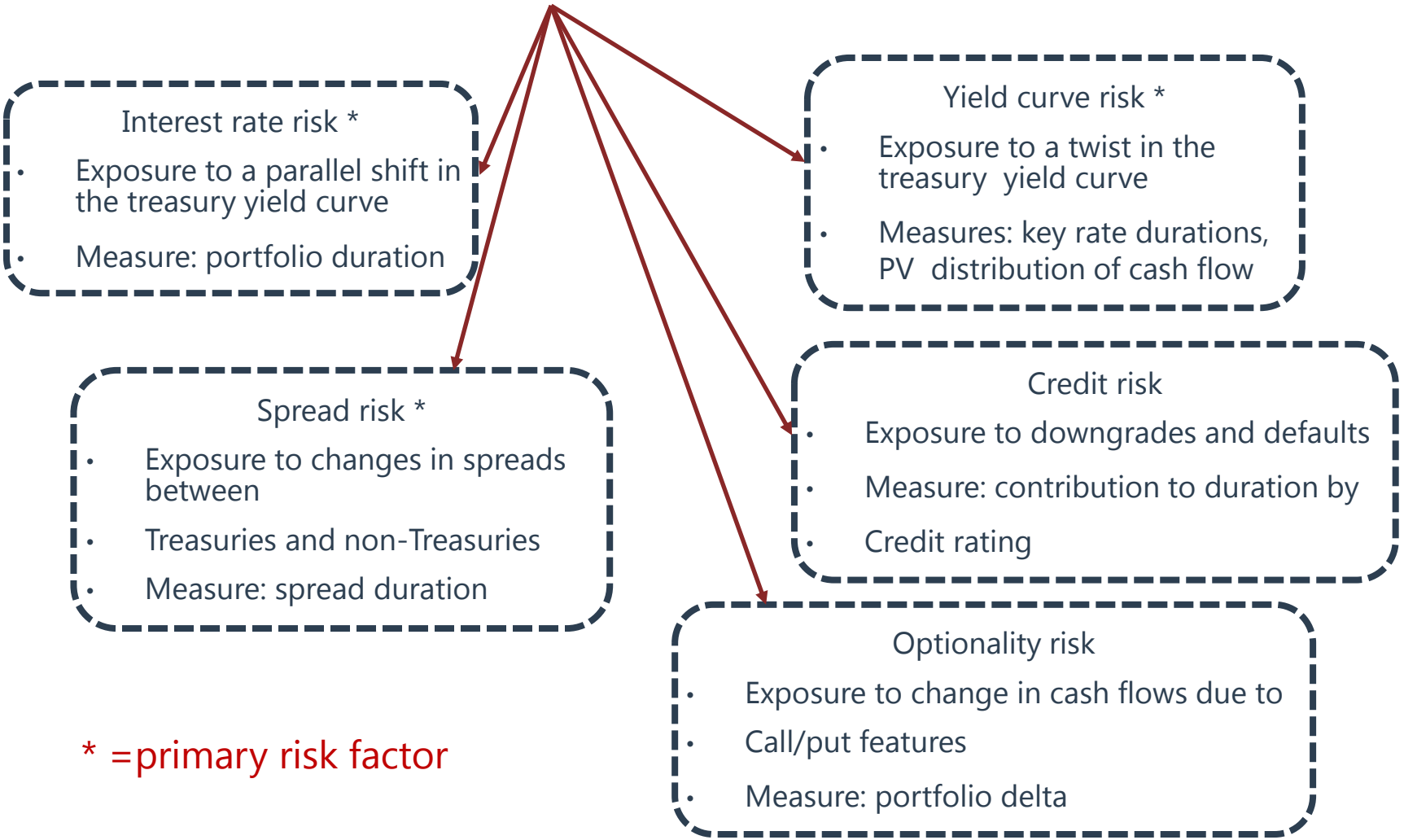
Example

- **Correct Answer: C.**
  - Pure indexing attempts to replicate the performance of a bond index. It seeks to exactly match all of the risk factors of the index while still allowing the manager some leeway on the individual bonds selected.
  - Enhanced indexing allows some additional flexibility in constructing the portfolio and seeks to add some modest active return. Active management allows much larger deviations from the risk factors of the index and seeks greater active return.

Bond Portfolio Risk

补充

➢ Fixed-Income Portfolio Risks



* =primary risk factor

Example

- Identify the approach (pure indexing, enhanced indexing, or active management) that is most likely used by each fund, and support your choices by referencing the information in Exhibit.

Risk & Return Characteristics	Fund X	Fund Y	Fund Z	Bloomberg Barclays Global Aggregate Index
Average maturity(years)	8.61	8.35	9.45	8.34
Modified duration(years)	6.37	6.35	7.37	6.34
Average yield(%)	1.49	1.42	1.55	1.43
Convexity	0.65	0.60	0.72	0.60
Quality				
AAA	41.10	41.20	40.11	41.24
AA	15.32	15.13	14.15	15.05
A	28.01	28.51	29.32	28.78
BBB	14.53	14.51	15.23	14.55
BB	0.59	0.55	1.02	0.35
Not rated	0.45	0.10	0.17	0.05

Example

Risk & Return Characteristics	Fund X	Fund Y	Fund Z	Bloomberg Barclays Global Aggregate Index
Maturity Exposure				
0-3 years	21.43	21.67	19.20	21.80
3-5 years	23.01	24.17	22.21	24.23
5-10 years	32.23	31.55	35.21	31.67
10+ years	23.33	22.61	23.38	22.30
Country Exposure				
United States	42.55	39.44	35.11	39.56
Japan	11.43	18.33	13.33	18.36
France	7.10	6.11	6.01	6.08
United Kingdom	3.44	5.87	4.33	5.99
Germany	6.70	5.23	4.50	5.30
Italy	4.80	4.01	4.43	4.07
Canada	4.44	3.12	5.32	3.15
Other	19.54	17.89	26.97	17.49

Example

- **Correct Answer:**
  - **Fund Y most likely uses a pure indexing approach** because it provides the closest match to the Bloomberg Barclays Global Aggregate Index. ***The risk and return characteristics are almost identical*** between Fund Y and the benchmark. Furthermore, quality, maturity exposure, and country exposure deviations from the benchmark are very minor.

Example

- **Correct Answer:**
  - **Fund X most likely uses an enhanced indexing approach**. Fund X's ***modified duration and convexity are very close to those of the benchmark but still differ slightly***. The ***average maturity*** of Fund X is ***slightly longer*** than that of the benchmark, whereas Fund X's ***average yield is slightly higher*** than that of the benchmark. Fund X also has ***deviations in quality, maturity exposure, and country exposures*** from the benchmark, providing further evidence of an enhanced indexing approach. Some of these deviations are meaningful; for example, Fund X has a relatively strong underweight in Japan.

Example

- **Correct Answer:**
  - **Fund Z most likely uses an active management approach** because ***risk and return characteristics, quality, maturity exposure, and country exposure differ markedly from the index***. The difference can be seen most notably with the ***mismatch in modified duration*** (7.37 for Fund Z versus 6.34 for the benchmark). Other differences exist between Fund Z and the index, but a sizable duration mismatch provides the strongest evidence of an active management approach.

3. Bond market liquidity

- **Fixed-income securities vary greatly in their liquidity**
  - Vs equity markets: less liquid & less transparent;
  - On-the-run liquidity > off-the-run liquidity;
  - Liquidity decreases→yield increases.

Bond market liquidity

➢ **Liquidity among bond market sub-sectors**

	More liquidity	Less liquidity	Reason
Issuers	Sovereign government bond	Corporate and non-sovereign government bond	• Issuance size • Use as benchmark bond • Acceptance as collateral in repo market • Well-recognized issuers
Credit quality	High credit quality	Lower credit quality	Find a counterparty dealer

Bond market liquidity

- **Liquidity among bond market sub-sectors**

	More liquidity	Less liquidity	Reason
Issue frequency	Outstanding issues	Infrequent issuers	Familiarity
Issue size	Larger issues	Smaller issues	Include or excluded in/from bond index with minimum issue size requirements
Maturity	Nearer-term bonds	Longer maturities bonds	Intent to hold them until maturity

Bond market liquidity

- **Effect of liquidity on fixed-income portfolio management**
  - **Pricing**
    - ✓ Electronic systems help to increase transparency;
    - ✓ **Matrix pricing**: use recent transaction prices of comparable bonds to estimate the market discount rate or required rate of return.
      - ◆ Advantage: not require sophisticated financial modeling;
      - ◆ Disadvantage: ignore some value-relevant features between different bonds.

Bond market liquidity

- **Effect of liquidity on fixed-income portfolio management**
  - **Portfolio construction**
    - ✓ Trade-off between yield and liquidity
    - ✓ 2 types of investors
      - ◆Buy-and-hold: prefer less liquid bonds for higher yields;
      - ◆Investors that emphasize liquidity, give up some yield.
    - ✓ Dealer market: often carry an inventory of bonds because buy and sell orders do not arrive simultaneously.
      - ◆Liquidity comparison: Bid-ask spreads comparison

Lower bid-ask spread (Higher liquidity)	**Higher bid-ask spread (Lower liquidity)**
Government bonds	Corporate bonds, structured financial instruments
Conventional bonds/plain vanilla bonds	Corporate bond with embedded options
Bonds of large, high-credit-quality corporations	Smaller, less creditworthy companies

4. Decompose expected returns

- Examining these components leads to a better understanding of the driving forces behind expected returns.
- **Expected returns [E(R)] can be decomposed**
  - E(R) ≈ yield income+rolldown return
    +E(change in price based on investor's view yields and yield spreads)
    -E(credit losses)
    +E(currency gains or losses)
    - ✓ Only approximately;
    - ✓ Better understand their own investment positions;
    - ✓ Applied to an annual period;
    - ✓ Not reflect taxes.

Yield income

- **Yield income** is the income that an investor receives from coupon payments relative to the bond's price as well as interest on reinvestment income.
  - $\text{Yield income} = \dfrac{\text{annual coupon payment}}{\text{current bond price}}$

    ✓ ***Annual coupon payment*** **= coupon + reinvestment income**

    ✓ When reinvestment income=0, yield income = current yield

Rolldown return

- **Rolldown return:** return results from the bond "rolling down" the yield curve as the time to maturity decrease, assuming zero interest rate volatility.
  - Equals the bond's percentage price change ***assuming an unchanged yield curve*** over the strategy horizon.
  - $$\text{Rolldown return} = \frac{\text{Bond price}_{\text{end}} - \text{Bond price}_{\text{beginning}}}{\text{Bond price}_{\text{beginning}}}$$
- ***Roll yield*** **= yield income + rolldown return**

Expected change in price based on yields

- The ***expected change in price based on*** investor's views of yields and yield spreads reflects an investor's expectation of ***changes in yields and yield spreads*** over the investment horizon.
  - $$\text{E}(\Delta\text{price based on investor's view of yields and yield spreads})$$
    $$=\text{-modified duration}\times\Delta\text{yield}+\frac{1}{2}\times\text{convexity}\times(\Delta\text{yield})^2$$
  - Expected change=0 if expected yield curves and yield spreads to remain unchanged
  - Convexity estimates the effect of the non-linearity of the yield curve
  - Embedded option: effective duration, effective convexity
  - Floating rate notes have modified duration near zero

Expected credit loss & currency gain/loss

- **Expected credit loss** represent the expected percentage of par value lost to default for a bond.
  - Expected credit losses
    =Probability(default)×expected loss severity(loss given default)
- **Currency gain or loss**
  - Any expected fluctuations in the currency exchange rate or expected currency gains or losses over the investment horizon.
  - Can be locked in over the investment horizon using currency forwards.

Estimation of the inputs

- **Easiest component:** yield income.
- **Relatively straightforward:** rolldown return.
- **Most uncertain**
  - Investor's views of changes in yields and yield spreads;
  - Expected credit loss;
  - Expected currency movements.

Example

- Ann manages a British pound-denominated corporate bond portfolio. Her department head in New York has asked Ann to make a presentation on **the next year's total expected return** of her portfolio in US dollars and the components of this return. The following shows information on the portfolio and Ann's expectations for the next year.
- Calculate the total expected return of the bond portfolio, assuming no reinvestment income.

Example

Notional principal of portfolio (in million)	£100
Average bond coupon payment (per £100)	£2.75
Coupon frequency	Annual
Investment horizon	1 year
Current average bond price	£97.11
Expected average bond price in one year (assuming an unchanged yield curve)	£97.27
Average bond convexity	0.18
Average bond modified duration	3.70
Expected average yield and yield spread change	0.26%
Expected credit losses	0.10%
Expected currency losses (£ depreciation versus US$)	0.50%

Example

- **Correct Answer:**
  - **Yield income** over a one year horizon=2.75/97.11= 2.83%.
  - **Rolldown return**=(97.27-97.11)/97.11=016%.
  - **Roll yield**=yield income + rolldown return=2.83%+0.16%=2.99%.
  - **The expected change in price** based on Ann's views of **yields and yield spreads**=(-3.70*0.0026)+[1/2*0.18*$(0.0026)^2$]=-0.96%.
  - **Expected credit losses**=0.1%.
  - **Expected currency losses** (£ depreciation versus US$)=0.5%.
  - **Total expected return**=1.43%.

5. Leverage

- **Leverage** is the use of borrowed capital to increase the magnitude of portfolio positions, and it is an important tool for fixed-income portfolio managers.
- **Leveraged portfolio return (Rp)**

$$R_p = \frac{\text{Portfolio return}}{\text{Portfolio equity}} = \frac{(V_E + V_B)r_I - V_B r_B}{V_E} = \frac{V_E r_I + V_B r_I - V_B r_B}{V_E} = r_I + \frac{V_B}{V_E}(r_I - r_B)$$

  - ✓ Including: V_E=value of portfolio equity
    V_B=borrowed funds
    r_B=borrowing rate (cost of borrowing)
    r_I=return on the invested funds (investment return)
    r_P=return on the levered portfolio
  - ✓ If $r_I > r_B$, leverage increase the portfolio's return
  - ✓ If $r_I < r_B$, leverage decrease the portfolio's return
- **Leverage effect on duration**

$$D_P = D_i + \frac{V_B}{V_E}(D_i - D_B)$$

Methods for leveraging fixed-income portfolio

- Derivatives or borrowing are explicit forms of leverage. Other forms of leverage, such as the use of structured financial instruments, are more implicit.
  - **Futures contracts**
    - ✓ Futures contract's notional value
      = current value of underlying asset x multiplier
    - ✓ $\text{leverage}_{\text{futures}} = \dfrac{\text{notional value-margin}}{\text{margin}}$
  - **Swap agreement**
    - ✓ Fixed-rate payer: short a fixed-rate bond + long a floating-rate bond→i↗ →value↗
    - ✓ Fixed-rate receiver: long a fixed-rate bond + short a floating-rate bond→i↘ →value↗
    - ✓ Equivalent to a long-short bond portfolio: provide leveraged exposure to bonds

Methods for leveraging fixed-income portfolio

- **Structured financial instruments (structured products)**
  - ✓ **Inverse floating-rate note (inverse floater)**
    - ◆Coupon rate = C – L x R
    - ◆Strong view that interest rates will remain low or possibly
- **Repurchase agreements (repos)**
  - ✓ Important source of short-term financing
  - ✓ Repos are effectively collateralized loans
  - ✓ Repo rate: interest rate on a repurchase agreement
  - ✓ $\text{Dollar interest} = \text{principal amount} \times \text{repo rate} \times \frac{\text{term of repo in days}}{360}$

Methods for leveraging fixed-income portfolio

- **Securities lending**
  - ✓ Short sales: sale of securities the seller does not own
  - ✓ Financing-motivated security loan: a bond owner lends the bond to another investor in exchange for cash
  - ✓ Unlike repos, securities lending transactions are typically open-ended. Lender may recall the securities at any time, forcing the borrower to deliver the bonds by buying them back or borrowing from another lender.
  - ✓ **Rebate rate = Collateral earnings rate – Security lending rate**

Risk of leverage

- Leverage alters the risk-return properties of an investment portfolio. A heavily leveraged portfolio may incur ***significant losses*** even when portfolio assets suffer only moderate valuation declines.
  - Leverage can lead to ***forced liquidations***. If the value of the portfolio decreases, the portfolio's equity relative to borrowing levels is reduced and the portfolio's leverage increases. Portfolio assets may be sold in order to pay off borrowing and reduce leverage.
  - If portfolio assets are not liquidated, then the overall leverage increases, corresponding to ***higher levels of risk***.
  - Decreases in portfolio value can lead to forced liquidations even if market conditions are unfavorable for selling-for example, during crisis periods. The term "***fire sale***" refers to forced liquidations at prices that are below fair value as a result of the seller's need for immediate liquidation.

6. Fixed-income portfolio taxation

- **Principles of fixed-income taxation**
  - 2 primary sources of investment income
    - ✓ Coupon payments (investment income);
    - ✓ Capital gains or losses.
  - Tax is payable only on capital gains and interest income that have actually been received
    - ✓ **Zero-coupon bond**: return on a zero-coupon bond is not taxed entirely as a capital gain;
    - ✓ $t_{S-T\ capital\ gain} > t_{L-T\ capital\ gain}$

      $t_{capital\ gain} < t_{interest\ income/coupon}$
    - ✓ Capital loss不能用于抵减coupon; Capital loss只能用于抵减capital gain; Capital loss:当年的loss能抵税部分叫做“carried forward”到未来.

Example

- **Managing Taxable and Tax-Exempt Portfolios**
- A bond portfolio manager needs to raise €10,000,000 in cash to cover outflows in the portfolio she manages. To satisfy her cash demands, she considers one of two corporate bond positions for potential liquidation: Position A and Position B. For tax purposes, capital gains receive pass-through treatment; realized net capital gains in the underlying securities of a fund are treated as if distributed to investors in the year that they arise. Assume that the capital gains tax rate is 28% and the income tax rate for interest is 45%. The following Exhibit provides relevant data for the two bond positions.

Example

	Position A	Position B
Current market value	€10,000,000	€10,000,000
Capital gain/loss	€1,000,000	-€1,000,000
Coupon rate	5.00%	5.00%
Remaining maturity	10 years	10 years
Income tax rate	45%	
Capital gains tax rate	28%	

- The portfolio manager considers Position A to be slightly overvalued and Position B to be slightly undervalued. Assume that the two bond positions are identical with regard to all other relevant characteristics. How should the portfolio manager optimally liquidate bond positions if she manages a portfolio for:

1. tax-exempt investors?
2. taxable investors?

Example

1. **Correct Answer:**
   - The taxation of capital gains and capital losses has minimal consequences to tax-exempt investors. Consistent with the portfolio managers investment views, the portfolio manager would likely **liquidate Position A**, which she considers slightly overvalued rather than liquidating Position B, which she considers slightly undervalued.

Example

2. **Correct Answer:**
   - All else equal, portfolio managers for taxable investors should have an incentive to defer capital gains taxes and realize capital losses early (tax-loss harvesting) so that losses can be used to offset current or future capital gains. Despite the slight undervaluation of the position, the portfolio manager might want to **liquidate Position B** because of its embedded capital loss, which will result in a lower realized net capital gain being distributed to investors. This decision is based on the assumption that there are no other capital losses in the portfolio that can be used to offset other capital gains. Despite the slight overvaluation of Position A, its liquidation would be less desirable for a taxable investor because of the required capital gains tax.

Liability-Driven and Index-Based Strategies

Framework

1. Liability- driven investing
   - Types of liability
   - Managing single liability
   - Managing multiple liabilities
   - Derivatives overlay
   - Example of DB plan
   - Risks in liability-driven investing
2. Matching a fixed-income portfolio to an index
   - Pure indexing
   - Enhanced indexing
   - Benchmark selection
3. Laddered bond portfolio

1. Describe LDI

- **Asset-liability management**
  - Consider both assets and liabilities in the portfolio decision-making process;
  - Provide better balance on the interest rate exposure of assets and liabilities;
  - The coordinated rate decisions and measurement of gaps between asset and liability would reduce the interest rate risk.

Describe LDI

- **Liability-driven investing (LDI) and asset-driven liability (ADL) are special cases of ALM**
  - With **ADL**, the ***assets are given*** and ***liabilities are structured to manage*** interest rate risk.
    - ✓ Example: a leasing company with short-term contracts that chooses to finance itself with short-term debt;
  - With **LDI**, the ***liabilities are given and assets are managed***.
    - ✓ Example: life insurance company acquires a liability portfolio based on the insurance policies underwritten by its sales force.

1.1 Types of liability

	Type I liability	Type II liability	Type III liability	Type IV liability
Cash outlay amount	Known	Known	Unknown	Unknown
Timing	Known	Unknown	Known	Unknown
Example	Fixed income bond having no embedded options	Callable bond Putable bond Term life insurance	Floating rate note Structure notes have principal inflation indexed bonds	Property and casualty insurance company DB plan
Advantage	Yield duration statistics can be used to measure the interest rate sensitivity of the liability			

1.2 Managing single liability

- **LDI**
  - Manage the interest rate risk on single liability
    - ✓ Risk of the classic investment strategy known as interest rate immunization.
    - ✓ **Immunization:** The process of structuring and managing a fixed-income bond portfolio to minimize the variance in the realized rate of return over a known time horizon.

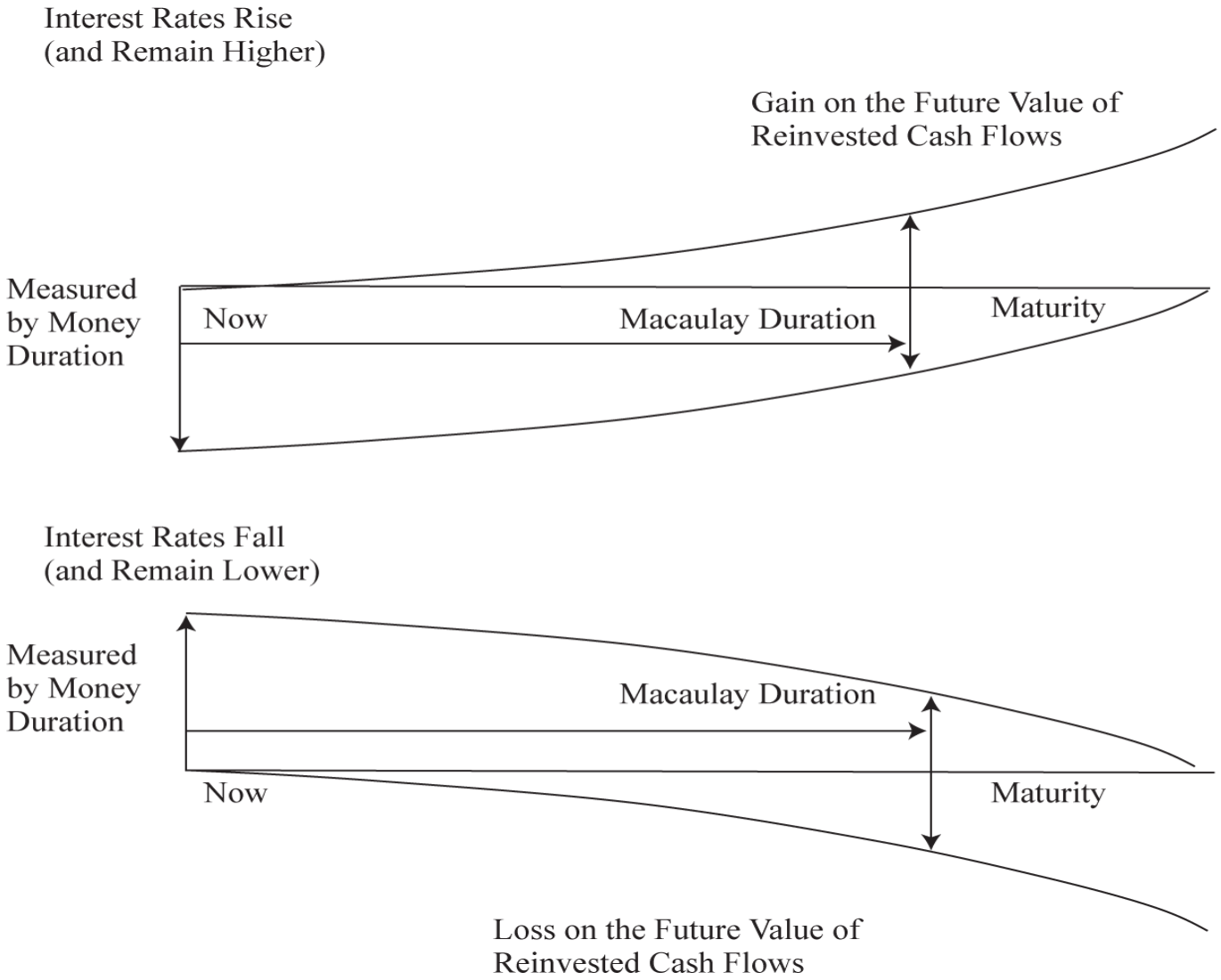
Managing single liability

- **Interest rate risk immunization**
  - The most obvious way: ***buy a zero-coupon bond*** that matures on the obligation's due date, and the face value matches the liability amount.
    - ✓ **No cash flow reinvestment risk➔** there are no coupon payments to reinvest;
    - ✓ **No price risk➔** the bond is held to maturity.
    - ✓ However, zero-coupon bonds are ***not always available***.

Managing single liability

- **Interest rate immunization**
  - Immunization can be reached by ***using a coupon bearing fixed-income bonds***.
    - ✓ The bonds exposed to **interest rate risk**: the bond's value falls when the yield curve upward shift;
    - ✓ The bonds exposed to **reinvestment risk**: the reinvestment return increases as the yield curve upward shift.
    - ✓ At Macaulay duration, the two effects, the price effect and the coupon reinvestment effect, cancel each other.
    - ✓ Investors can have an investment horizon equal to the bond's Macaulay duration.

Managing single liability



Managing single liability

- **Interest rate immunization**
  - Immunizing with coupon bearing bonds needs to continuously ***match the portfolio Macaulay duration with the Macaulay duration of the zero-coupon bond*** over time.
    - ✓ The Macaulay duration of zero-coupon bond always matches the investment horizon.
  - The bond portfolio's ***initial market value*** has to ***match or exceed*** the ***present value of the zero-coupon bond***;
  - The **interest rate risk** to an immunization strategy is that the change in the cash flow yield on the portfolio is not the same as on the ideal zero-coupon bond.

Managing single liability

- **Interest rate immunization**
  - **Key assumption** to achieve immunization: any ***ensuing change in the cash flow yield on the bond portfolio is equal to the change in the yield to maturity on the zero-coupon bond***.
    - ✓ A sufficient but not necessary condition: ***a parallel shift to the yield curve***.
      - ◆Sufficient: if the yield curve shift is parallel, the change in the bond portfolio's cash flow yield will equal the change in yield to maturity of the zero-coupon bond, which is enough to ensure immunization.
      - ◆However, it is not necessary that the yield curve shifts in a parallel manner to achieve immunization.

Managing single liability

- **Structural risk**
  - **Definition:** Structural risk arises from portfolio design, particularly the choice of the portfolio allocations.
  - The risk arise because ***yield curve twists and non-parallel shifts*** lead to changes in the cash flow yield that do not match the yield to maturity of the zero-coupon bond that provides for perfect immunization;
  - Structural risk is ***reduced by minimizing the dispersion (convexity)*** of the bond positions;
    - ✓ For ***zero-coupon bond***, it matches the date of the single obligation, and it has ***no structural risk***.

$$\text{convexity} = \frac{\text{Mac. Duration}^2 + \text{Mac. Duration} + \text{Dispersion}}{(1 + \text{cash flow yield})^2}$$

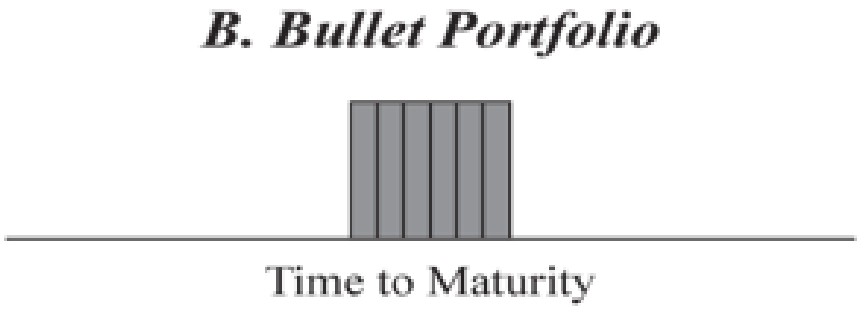
Managing single liability

- **The characteristics of a bond portfolio structured to immunize a single liability**
  - Has an initial market value that equals or exceeds the present value of the liability;
  - Has a portfolio Macaulay duration that matches the liability's due date;
  - ***Minimizes the portfolio convexity*** statistic.
- **The portfolio must be regularly rebalanced over the horizon to maintain the target duration**
  - The portfolio's Macaulay duration changes as time passes and yields change;
  - A trade-off between incurring transaction costs from rebalancing and allowing some duration gap.

Bullet and Barbell Strategies

来自SS12

- **Bullet portfolio:** targeting a single segment of the curve, lower dispersion of cash flows, lower convexity.



- **Barbell portfolio:** combining securities concentrated in short and long maturities, higher dispersion of CF, higher convexity.

Example

- An institutional client asks a fixed-income investment adviser to recommend a portfolio to immunize a single 10-year liability. The adviser proposes two portfolios of coupon-bearing government bonds because zero-coupon bonds are not available, and the portfolios have the same market value. The institutional client's objective is to minimize the variance in the realized rate of return over the 10-year horizon. The two portfolios have the following risk and return statistics:

	Portfolio A	Portfolio B
Cash flow yield	7.64%	7.65%
Macaulay duration	9.98	10.01
Convexity	107.88	129.43

Example

- Statistics are based on aggregating the interest, and principal cash flows for the bonds that constitute the portfolios;
- The cash flow yield is stated on a semi-annual bond basis
- The Macaulay durations and convexities are annualized.

Indicate the portfolio that the investment adviser should recommend, and explain the reasoning.

Example

- **Correct Answer:**

  The adviser should recommend Portfolio A.

  First, **the cash flow yields of both portfolios are the same, and both portfolios have Macaulay durations close to 10, the horizon for the liability**. The convexity for two portfolios are 107.88 and 129.43, a more convex bond gains more if the yield goes down and loses less if the yield goes up than a less convex bond.

  The client's objective is to minimize the variance in the realized rate of return over the 10-year horizon, **which indicates a conservative immunization strategy by building the duration matching portfolio and minimizing the portfolio convexity**.

  The structural risk leads to changes in the cash flow yield that do not track the change in the yield on the zero-coupon bond. This risk is minimized by selecting the portfolio with the lower convexity (and dispersion of cash flows).

  Default risk is neglected in this discussion

1.3 Managing multiple liabilities

- **Approaches to manage multiple liabilities**
  - **Cash flow matching**
    - ✓ Entails building a dedicated portfolio of zero-coupon or fixed-income bonds to ensure that there are sufficient cash inflows to pay the scheduled cash outflows.
  - **Duration matching**
    - ✓ Extends the ideas of the previous section to a portfolio of debt liabilities.
  - **Contingent immunization**
    - ✓ Allows for active bond portfolio management until a minimum threshold is reached and that threshold is identified by the interest rate immunization strategy.

Cash flow matching

- It is a classic strategy to ***eliminate the interest rate risk*** through building a dedicated asset portfolio of high-quality fixed-income bonds, so that ***matches the amount and timing of the scheduled cash outflows***.
  - Each cash flow are placed in a held-to-maturity portfolio
- **Why company do not buy back and retire its liabilities?**
  - The buyback strategy would be difficult and costly;
  - Most corporate bonds are rather illiquid
  - The corporate has motivation to improve the company's credit rating by cash flow matching.

Cash flow matching

- **Accounting defeasance**
  - A way of extinguishing a debt obligation by setting aside sufficient high quality securities, such as US Treasury notes, to repay the liability.
- **A concern for cash flow matching strategy is the cash-in-advance constraint**
  - **Cash-in-advance constraint** means securities are not sold to meet obligations;
  - For company, sufficient funds must be available on or before each liability payment date to meet the obligation;
  - There might be large cash holdings between payment dates, so cash reinvestment risk would be faced, as the short-term investments returns are relatively low.

Duration matching

- **Duration matching for multiple liabilities**
  - The money duration of the immunizing portfolio matches the money duration of the debt liabilities;
  - Market values and cash flow yields of the assets and liabilities are not necessarily equal.
  - **Match money duration is useful.**
- **Basis point value (BPV)** is used to measure money duration, means ***1bps change in cash flow yield, the market value change***.

Duration matching

- **Immunization of multiple liabilities is essentially an interest rate risk hedging strategy**
  - Changes in the market value of the asset portfolio closely match changes in the debt liabilities whether interest rate changes.
  - Although money duration for assets and liabilities are the same, the difference in structure of asset and liability shows a ***difference in dispersion and convexity***.
- **Rebalancing is needed**
  - In theory, asset manager needs to make a rebalance when needed, so that the money duration of the asset can match the money duration of the liability;
  - In reality, the manager likely waits until the ***mismatch is large enough*** to justify the transactions costs in selling some bonds and buying others.
  - Method to rebalance
    - ✓ Sell or buy the bonds;
    - ✓ Use interest rate derivatives.

Contingent immunization

- **Contingent immunization**
  - The presence of a ***significant surplus*** allows the asset manager to consider a hybrid passive-active strategy;
  - The idea behind contingent immunization is that asset managers can pursue active investment strategies.
    - ✓ When actively managed assets performed poorly, the mandate reverts to the purely passive strategy of building a duration matching portfolio, and then managing it to remain on duration target.

1.4 Derivatives overlay

- **Higher or lower interest can arise from**
  - Change in expected inflation;
  - Change in monetary policy;
  - Change in macroeconomic conditions.
- **Interest rate derivatives** can be a cost-effective method to **rebalance the immunizing portfolio to keep it on its target duration** as the yield curve shifts and twists and as time passes.
- To analyze the LDI for single and multiple liabilities, the essential relationship for **full interest rate hedging** can be summarized as
  - $\text{asset BPV} \times \Delta\text{asset yields} + \text{hedge BPV} \times \Delta\text{hedge yield} \approx \text{liability BPV} \times \Delta\text{liability yields}$

Derivatives overlay

- **Calculate the required number of futures contract (N_f)**
  - $\text{asset portfolio BPV} + N_f \times \text{futures BPV} = \text{liability portfolio BPV}$
  - $$N_f = \frac{\text{liability portfolio BPV-Asset portfolio BPV}}{\text{futures BPV}}$$
    - ✓ If N_f is a ***positive*** number ➔ the asset manager goes ***long*** the required number of futures contracts;
    - ✓ If N_f is a ***negative*** number ➔ the asset manager goes ***short*** the required number of futures contracts.
  - **Decided by cheapest-to-deliver bond's duration**
    - ✓ Achieving the target duration (liability portfolio)

$$FuturesBPV = \frac{BPV_{CTD}}{CF_{CTD}}$$

Derivatives overlay

- **Use interest swap**
  - The notional principal (NP) on the interest rate swap needed to close the duration gap to zero can be calculated by using the formula
    - ✓ **Asset BPV+ NP* Swap BPV/100= liability BPV**
    - ✓ $$\text{NP} = \frac{\text{liability portfolio BPV-Asset portfolio BPV}}{\text{Swap BPV/100}}$$
- **Swaption**
  - Instead of entering a swap, the pension fund could purchase an option to enter a similar received-fixed swap, which is called a receiver swaption.
    - ✓ **Increase duration**: enter a ***receiver swaption***
    - ✓ **Decrease duration**: enter a ***payer swaption***

Derivatives overlay

- **Hedging ratio:** the extent of interest rate risk management
  - A hedge ratio of ***0%*** indicates ***no hedging*** at all;
  - A hedge ratio of ***100%*** means ***fully immunized***;
  - In practice, the partial hedge ratios are common.
- **Flexibility in selecting the hedge ratio**
  - When interest rate are ***lower***, plan manager would have ***higher hedging ratio***;
  - When interest rate are ***higher***, plan manager would have ***lower hedging ratio***;
- In all likelihood, the prudent course of action for the manager is to ***use a partial hedge*** rather than attempt to reduce the duration gap to zero.

Derivatives overlay

- An asset manager want to use futures exchange to manage the gaps that arise from "duration drift" in a portfolio of German government bonds that are used to immunize a portfolio of corporate debt liabilities. This futures contract has a notional principal of EUR 100,000 and a 6% coupon rate. The German government bonds that are eligible for delivery have maturities between 8.5 years and 10.5 years.
  - Market value of the debt is EUR 330,224,185
  - Modified duration of debt is 7.23
  - **BPV of the debt is EUR 238,752.**
  - Market value of the asset portfolio is EUR 332,216,004
  - Modified duration of the asset portfolio is 7.42
  - BPV of the asset portfolio is EUR 246,504.
  - BPV for each futures contract is EUR 65.11.

  1) Does the asset manager go long (buy) or go short (sell) the futures contract?

  2) How many contracts does the manager buy or sell to close the duration gap?

Derivatives overlay

- **Correct Answer:**

  1) The money duration of the assets, as measured by the BPV, is greater than the money duration of debt liabilities. This relationship is true of the modified duration statistics as well, but the money duration is a better measure of the gap because the market values differ. The asset manager needs to go short (or sell) Long Bund futures contracts.

  2) $$N_f = \frac{\text{liability portfolio BPV-Asset portfolio BPV}}{\text{futures BPV}}$$

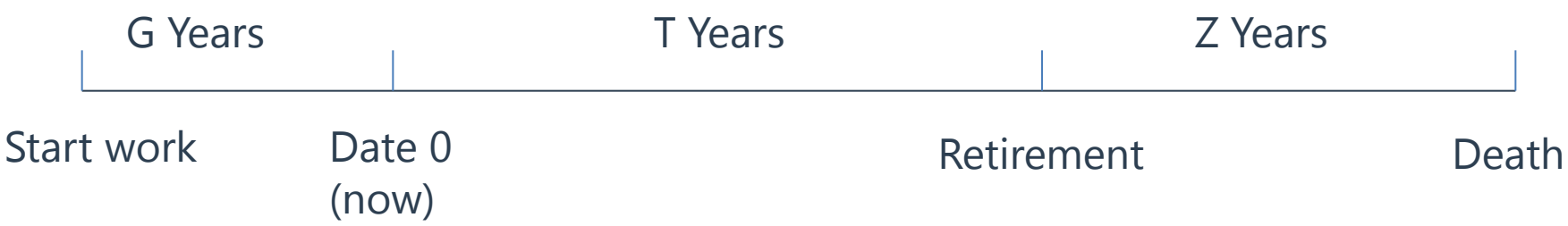
  Liability portfolio BPV=238,752, asset portfolio BPV=246,504, and future's BPV=65.11

  Nf=-119.06

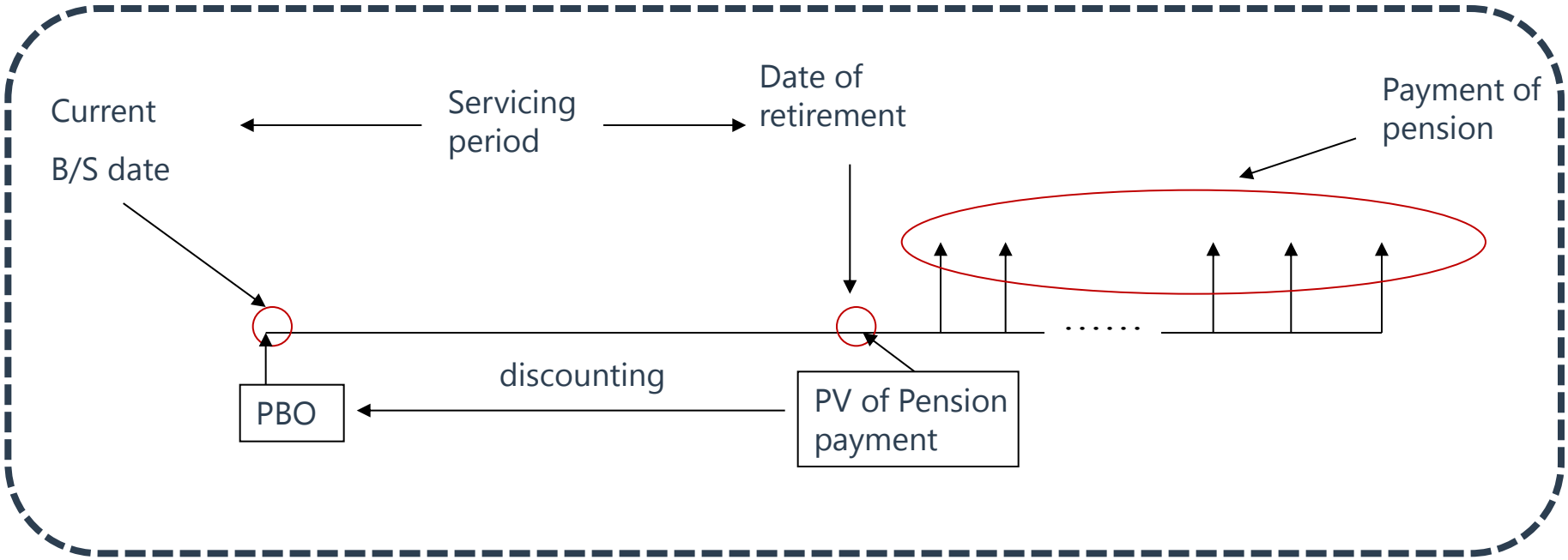
  Asset managers should go short 119 contracts to close the duration gap.

1.5 LDI---example of DB plan

- **DP plan**
  - A good example of type IV liabilities;
  - Both amounts and dates are uncertain.
- **Basic assumptions**
  - This employee has worked for G years, a sufficient length of time to ensure that retirement benefits are vested;
  - The employee is expected to work for another T years;
  - The employee will retire and live for Z years then.



LDI---example of DB plan



- The payment of pension after the retirement is committed by the firm. Therefore, these cost should be recognized during the servicing period of the employees. The present value of the cost as at the end of current year is called PBO
- The firm (sponsor) usually set up a fund to meet the liability.

LDI---example of DB plan

- **Two measures of the retirement obligation**
  - Accumulated benefit obligation (ABO)
    - ✓ Calculates the liability based on the G years worked and **current wage W_0**; m is a multiplier.
    - ✓ The use of the current annual wage and the number of years worked is because the ABO represents the legal liability today;
    - ✓ ABO is the present value of the annuity, discounted at an annual rate on high-quality corporate bond.
    - ✓ $$ABO = \frac{1}{(1+r)^T} \times [\frac{m \times G \times W_0}{1+r} + \frac{m \times G \times W_0}{(1+r)^2} + \ldots + \frac{m \times G \times W_0}{(1+r)^Z}]$$
    - ✓ $$ABO = \frac{m \times G \times W_0}{(1+r)^T} \times [\frac{1}{r} - \frac{1}{r \times (1+r)^Z}]$$

LDI---example of DB plan

- **Two measures of the retirement obligation**
  - Projected benefit obligation
    - ✓ Uses the **projected wage for year T** instead of the current wage in the Z-year annuity, $\mathbf{W_T}$;
    - ✓ It is the liability reported in financial statements and used to assess the plan's funding status.
    - ✓ $PBO = \frac{1}{(1+r)^T} \times [\frac{m \times G \times W_T}{1+r} + \frac{m \times G \times W_T}{(1+r)^2} + \ldots + \frac{m \times G \times W_T}{(1+r)^Z}]$
    - ✓ $PBO = \frac{m \times G \times W_0 \times (1+w)^T}{(1+r)^T} \times [\frac{1}{r} - \frac{1}{r \times (1+r)^Z}]$
    - ✓ PBO always larger than the ABO by the factor of $(1+w)^T$, assuming positive wage growth in nominal terms.

LDI---example of DB plan

- **Assuming w is less than r**
  - Employees are generally compensated for price inflation, and some part of real economic growth, as well as for seniority and productivity improvements;
  - But overall the labor income growth rate does not quite keep pace with the nominal return on high-quality financial assets.
- **Longevity risk**
  - The risk that employees live longer in their retirement years than assumed in the model;
  - The higher value of Z increases both the ABO and PBO measures of liability.

LDI---example of DB plan

- **Choose ABO or PBO?**
  - If the corporation want to convert the retirement plan from DB to DC, the ABO measure matters more than PBO;
  - If the sponsor sees itself as an ongoing independent institution that preserves the pension plan's current design, PBO is more appropriate measure for pension plan liabilities.

1.6 Risks in LDI

- **Risks in LDI**
  - Model risk
  - Interest rate risk
  - Yield curve risk
  - Spread risk
  - Credit risk
  - Collateral exhaustion risk
  - Liquidity risk

Risks in LDI

- **Model risk**
  - The risk that the assumptions in the model turn out to be wrong and the approximations are inaccurate
    - ✓ Previously, the effective duration of the alternative and equity are assumed to be 0, this assumption might be wrong, leading to the mis-measurement of the asset BPV.
    - ✓ Measurement error for asset BPV can also arise in the classic immunization strategy for type I cash flows;
    - ✓ The measurement error for asset BPV is minimized when the underlying yield curve is flat or when future cash flows are concentrated in the flattest segment of the curve.
    - ✓ The model assumes that the change of asset yield, hedge yield and liability yields are the same, and this would increase the model risk as well.

Risks in LDI

- **Interest rate risk**
  - Approximations are based on duration, but convexity ignored.
- **Yield curve risk**
  - Non-parallel shift of yield curve. Minimizing dispersion of the cash flows in the asset portfolio mitigates this risk.
- **Spread risk**
  - The risk that the respective spreads on the broad index and the high quality sector do not move in unison with a shift in the government bond yield curve;
  - Yields on high-quality corporate bonds are less volatile than more-liquid treasuries.
  - There is less volatility in the corporate/swap spread than in the corporate/Treasury spread.

Risks in LDI

- **Counterparty credit risk**
  - May occur when interest rate swap overlay are uncollateralized.
  - It entails the joint probability of default by the counterparty and movement in market rates that results in the swap being valued as an asset.
- **Collateral exhaustion risk**
  - Derivatives used in LDI strategy introduces a new risk factor——the risk that available collateral becomes exhausted.
  - In pension plan, it would need to enter a sizable derivatives overlay;
  - The same concern about cash management and collateral availability arises with the use of exchange –traded futures contracts.
- **Liquidity risk**
  - A risk factor in strategies that combine active investing to the otherwise passive fixed-income portfolio.

2. Matching a FI portfolio to an index

- **Basic terminologies**
  - **Tracking risk:** deviation of returns on the selected portfolio from bond market index returns;
    - ✓ **Tracking error:** the standard deviation of a portfolio's active return for a given period, and active return is defined as
      - ◆Active return= portfolio return- benchmark index return
  - **Pure indexing:** the investor aims to replicate an existing market index by purchasing all of the constituent securities in the index to minimize tracking risk;
    - ✓ **Full replication approach:** the purchase of all securities within an index
  - **Enhanced indexing strategy:** the investor purchases fewer securities than the full set of index constituents but matches primary risk factors reflected in the index.
  - **Active management:** involves taking positions in primary risk factors that deviate from those of the index in order to generate excess return.

Matching a fixed-income portfolio to an index

- **Fixed income market**
  - ***Unique characteristics*** which make them ***difficult to track***
  - Investors face significant challenges in replicating a bond market index
    - ✓ ***Size and breadth*** of the bond market
    - ✓ ***Wide array*** of fixed income security characteristics
    - ✓ ***Unique issuance and trading pattern*** of bonds
      - ◆The pattern would influence the index composition, construction, pricing and valuation.

2.1 Passive investment

- **Passive investment**
  - The one that seeks to mimic the prevailing characteristics of the overall investments available in terms of credit quality, types of borrower, maturity, and duration rather than express a specific market view;
  - The approach is ***consistent with the efficient market hypothesis***
    - ✓ Portfolio manager seeks to ***replicate*** broader fixed-income market ***performance rather than outperform the market***;
    - ✓ Not require in-depth analysis to achieve the above market return.
  - Consistent with the highest degree of portfolio diversification.

Passive investment

- **Bond market index replication**
  - Most straight forward strategy a manager use to mimic index performance;
  - Has the brief that active managers cannot consistently outperform the index on a risk-adjusted basis;
  - Do not require manager analysis;
  - The manager's task is to purchase or sell bonds when there are changes to the index in addition to managing inflows and outflows for a specific fund.
  - **Advantages**
    - ✓ Best means of ***diversification***.
  - **Disadvantage**
    - ✓ ***Neither feasible nor cost-effective*** for investors to pursue full replication.

Alternative Methods for Passive Investment

- **Mutual fund**
  - Pooled investment vehicles whose shares or units represent a proportional share in the ownership of the assets in an underlying portfolio.
  - Open-ended mutual fund
    - ✓ New shares may be issued or redeemed at the fund's NAV established at the end of each trading day
      - ◆NAV is calculated based on the fund's valuation of all existing assets minus liabilities, divided by the total number of shares outstanding.
      - ◆Characteristics
        - ☐ Economies of scale;
        - ☐ Better diversification;
        - ☐ The mutual fund must outline its stated investment objectives and periodic fees, but actual securities holdings are available on a retroactive basis;
        - ☐ Has no maturity date;
        - ☐ Be able to redeem their holdings at the fund's NAV

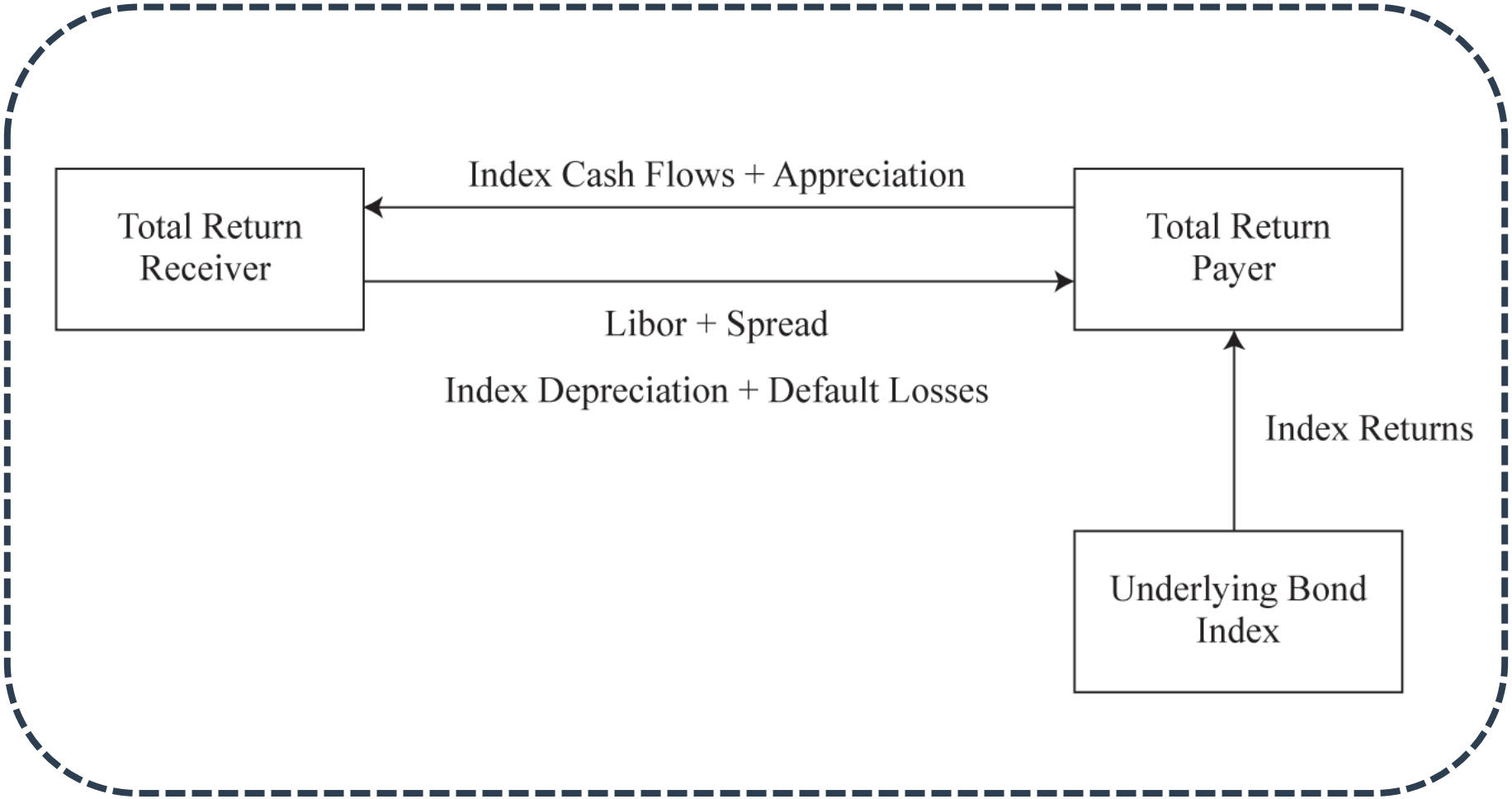
Alternative methods for passive investment

- **Exchange-traded funds**
  - Share some mutual fund characteristics, but have ***more tradability*** features.
  - Authorized participants
    - ✓ ETF solicit broker/ dealers
  - Creation units
    - ✓ Large block of ETF shares often traded against a basket of underlying securities.
  - ETF has ***greater liquidity*** than mutual funds, because of their availability to be purchased or sold ***throughout the trading day at a discount or premium relative to the NAV*** of the underlying bonds;
    - ✓ Authorized participant has arbitrage opportunity.
  - Synthetic strategies provide another arbitrage opportunity, as the portfolio manager can trade in both OTC and exchange traded market.

Alternative methods for passive investment

- **Total return swap (TRS)**
  - Combining elements of interest rate swaps and credit derivatives;
  - The most common over-the-counter portfolio derivative strategy.
  - Total return receiver: receives both the ***cash flows from the underlying index*** as well as any appreciation in the index over the period in exchange for ***paying LIBOR plus a pre-determined spread***.
  - The total return payer is responsible for paying the reference obligation cash flows, and return to the receiver but will also be compensated by the receiver for any depreciation in the index or default losses incur.

Alternative methods for passive investment



Alternative methods for passive investment

- **Total return swap**
  - **Attractiveness of TRS**
    - ✓ Efficient risk transfer on the reference obligation from one counter party to another on a confidential basis, with ***no requiring of the full cash outlay*** associated with the mutual fund or ETF purchase.
  - **Disadvantages of TRS**
    - ✓ The investor does ***not actually own the underlying assets***, but rather has a combined synthetic long position in both the market and credit risk of the index that is contingent upon the performance of the total return payer.
    - ✓ TRS allow investors to gain particular access to subsets of the fixed income markets. The markets are relatively illiquid, or the cost and administrative procedure are complex. All these prohibitive for the investor.

2.2 Enhanced indexing strategy

- **Enhanced indexing strategy**
  - The goal of the approach
    - ✓ Mirror the ***most important index characteristics***;
    - ✓ Closely track index performance.
  - General method: **stratified sampling**
    - ✓ Identify the characteristic of each cell or significant index portfolio;
    - ✓ The fixed-income portfolio manager identifies a subset of bonds or bond-linked exposures;
    - ✓ The positions in each cell are adjusted over time given changes to the underlying index versus existing portfolio positions.
    - ✓ The stratified sampling approach provides an asset manager the ability to optimize portfolio performance. Portfolio manager also seeks to minimize tracking error and limit the need to purchase or sell thinly traded securities.
  - The strategy aims to replicate the index performance under different market scenarios ***more efficiently*** than the full replication of a pure indexing approach.

Enhanced indexing strategy

- **Enhancement strategies for portfolio managers**
  - **Lower cost enhancement**
    - ✓ The most obvious enhancement is in the area of **cost reduction - reduce** fund expenses or reduce the bid-ask cost of trading.
  - **Issue selection enhancement**
    - ✓ By using **bond valuation models,** identify specific issues that are undervalued to their implied value, and help enhance the return.
  - **Yield curve enhancement**
    - ✓ Using **analytical models** to gauge and calculate relative value across the term structure of interest rates allows managers to develop strategies to both overweight undervalued securities and underweight overvalued securities.

Enhanced indexing strategy

- **Enhancement strategies for portfolio managers**
  - **Sector/ quality enhancements**
    - ✓ Overweighting specific bond and credit sectors across the business cycle to enhance returns, and other sectors are underweighted as a result.
  - **Call exposure enhancement**
    - ✓ Effective duration is a sufficient risk measure for relatively small rate changes;
    - ✓ Larger yield changes may affect bond performance significantly. Callable bonds are added to the portfolio, and the sensitivity to the price would be decreased.

Primary indexing risk factors

- **Risk factors for primary indexing**
  - **Portfolio modified adjusted duration**
    - ✓ ***Effective duration*** is the first approximation of an index's exposure to interest rate changes;
    - ✓ The factor is important in option-adjusted duration so that the analysis reflects securities with embedded call risk.
  - **Key rate duration**
    - ✓ Takes into account rate changes in a specific maturity along the yield curve while holding the remaining rates constant.
    - ✓ This measure gauges the index's sensitivity to ***non-parallel yield curve shifts***.

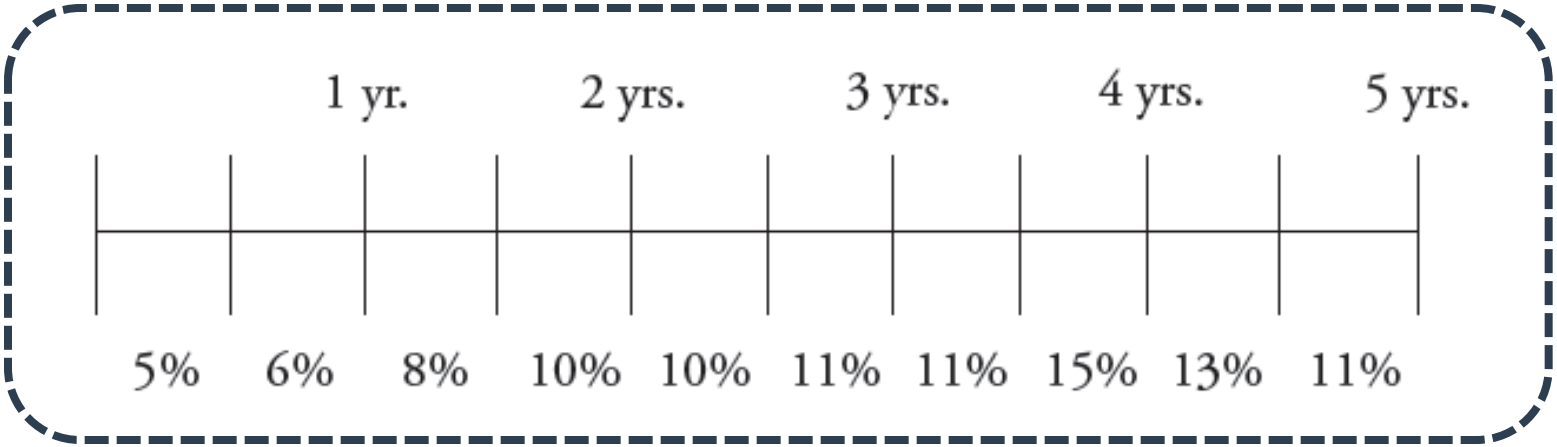
Non-parallel yield curve shifts

- **Present value of distribution of cash flows methodology (PVD)**
  - Divides the cash flows for each non-callable security in the index into discrete semi-annual periods and aggregates them.
  - Adds the cash flows for callable securities in the index based on the probability of call for each given period.
  - Compute the present value of aggregated cash flows for each semi-annual period, and the total present value of aggregated cash flows equal to the index's present value. The percentage of the present value of each cash flow vertex is calculated.
  - The time period is then multiplied by the present value of each cash flow.
  - Each period's contribution to duration is added to arrive at a total representing the bond index's duration.

Yield Curve Risk 2 – PVD 1

补充

- **PVD …**
  - Present value distribution of cash flow of the index used as the portfolio benchmark
  - PVD measures the proportion of the index's total duration attributable to cash flows falling within the selected time periods



Yield Curve Risk 2 – PVD 2

补充

Calculating PVD

$$Step\,1 \rightarrow w_i = PV(CF_i)/TPV(CF)$$

$$Step\,2 \rightarrow Duration_{C-i} = Duration_i \times w_i$$

$$Step\,3 \rightarrow Total\ Duration_C = \sum Duration_{C-i}$$

$$Step\,4 \rightarrow w_{DC} = D_{C-i}/TD_C$$

If a manager matches the weights in the final column for a portfolio to those of the portfolio's benchmark, duration will be matched as well as exposure along the yield curve.

Cash Flow					
Amount	*Due in Year*	*PV at periodic r of: 0.02*	*PV/Total PV*	*Duration Contribution*	*Duration Contributions as % of Total Duration*
1.500	0.500	1.471	0.015	0.007	0.005
1.500	1.000	1.442	0.015	0.015	0.010
101.500	1.500	95.646	0.970	1.455	0.985
bond price =		98.559	1.000	1.477	1.000

Primary indexing risk factors

- **Risk factors for primary indexing**
  - **Sector and quality spread duration contribution**
    - ✓ Portfolio manager minimize deviations from the benchmark by matching the amounts of index duration associated with the respective issuer sectors and quality categories;
    - ✓ **Spread duration** refers to the change in a non-treasury security's price given a widening or narrowing of the spread compared with the benchmark;
    - ✓ Matching the quality between the portfolio and the fixed-income index will minimize this risk.
  - **Percent in sector and quality**
    - ✓ Index yield is most effectively matched by targeting the same percentage weights across fixed income sectors and credit quality;
    - ✓ Refers to the issuers' type and industry segment of the bond issuer.

Primary indexing risk factors

- **Risk factors for primary indexing**
  - **Sector/ coupon/ maturity cell weights**
    - ✓ Asset managers face a number of challenges in matching price/ yield sensitivity beyond the use of effective duration.
    - ✓ For callable bond, its convexity may be negative, and there is a possibility that the bond can be called by the issuer. This makes the cost of rebalancing to be significant.
    - ✓ Managers seeks to match the sector, coupon and maturity weights of callable bonds by sector.
  - **Issuer exposure**
    - ✓ Concentration of issuers within a portfolio exposes the asset manager to issuer-specific event risk.

2.3 Benchmark selection

- It is **the final steps** in the broader asset allocation process and asset allocation start with a clear delineation of the portfolio manager's investment goals and objectives.

Asset allocation	
The manager must agree on an investment policy with asset owners, beneficiaries, and other constituents outlining return objectives, risk tolerance, and constraints to narrow choices available in the broader capital markets to meet these objectives.	
Strategic asset allocation	**Tactical asset allocation**
Targeting specific weightings for each permissible asset class is the result of this process	Provides the investment manager some short-term flexibility to deviate from these weightings in response to anticipated market changes.

Benchmark selection

- **Criteria for benchmark selection**
  - Benchmark selection must factor in the broad range of issuers and characteristics available in the fixed-income markets.
  - The use of an index as a widely accepted benchmark requires
    - ✓ Clear, transparent rules for security inclusion;
    - ✓ Weighting;
    - ✓ Investability;
    - ✓ Daily valuation;
    - ✓ Availability of past returns and turnover.

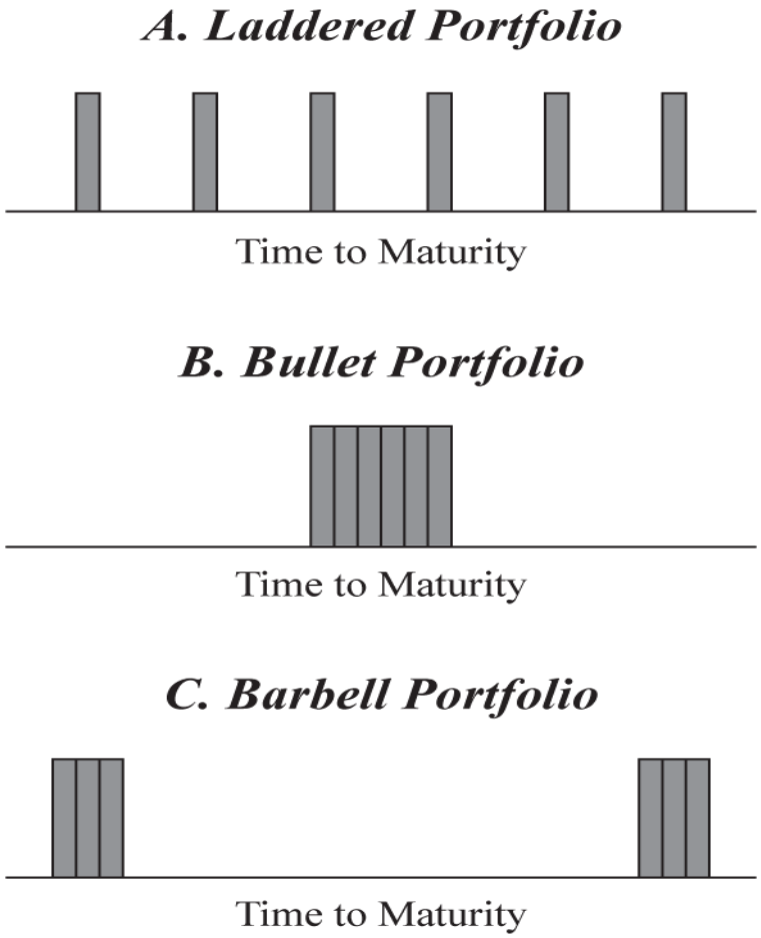
Benchmark selection

- **The dynamics of fixed income market require investors to more actively understand**
  - Their underlying duration preferences;
  - A desired risk and return profile within their fixed income allocation.
- **Smart beta**
  - Smart beta involves the use of simple, transparent, rules-based strategies as a basis for the well-established, static strategies that tend to drive excess portfolio returns;
  - In theory, asset managers can capture excess returns with similar transaction fees by using this strategy. It is more commonly used in equity manger, and fixed income manager start to use as well.

3. Laddered bond portfolio

- **Laddered portfolio**
  - **Laddered portfolio** spreads the bonds' maturities and par values more or less evenly along the yield curve;
  - **Bullet portfolio** concentrates the bonds at a particular point on the yield curve;
  - **Barbell portfolio** places the bonds at the short-term and long-term ends of the curve.
- **The way to build a ladder portfolio**
  - Build the ladder directly;
  - Use fixed-maturity corporate bond ETFs, and these ETFs have a designated year of maturity and credit risk profile.

Laddered Bond Portfolio



$$\text{convexity} = \frac{\text{Mac. Duration}^2 + \text{Mac. Duration} + \text{Dispersion}}{(1 + \text{cash flow yield})^2}$$

Laddered bond portfolio

- **Advantage to laddered portfolio**
  - ***Protection from shifts and twists***——the cash flows are essentially "***diversified***" across the time spectrum; the investor has a ***balanced position*** between cash flow reinvestment and market price volatility;
  - ***The convexity for ladder is in the middle*** of bullet and barbell, and compared to barbell, the ladder portfolio has much less cash flow reinvestment risk;
  - Ladder has ***advantage in liquidity management***, especially when bond is not actively traded.

Laddered Bond Portfolio

- **Limitations for ladder portfolio**
  - The decision to build a laddered bond portfolio should be weighed against buying shares in a fixed-income mutual fund;
    - ✓ Mutual fund provides greater diversification of default risk.
  - Actual bonds entails a much higher cost of acquisition;
  - Mutual fund shares can be redeemed more quickly than the bonds can be sold, and likely at a better price.

Example

- A Radford School Board member has stated that she prefers a bond portfolio structure that provides diversification over time, as well as liquidity. In addressing the board members inquiry, Ng examines a bullet portfolio, a barbell portfolio, and a laddered portfolio.
- Which portfolio structure should Ng recommend that would satisfy the school board member's preference?
  A. Bullet portfolio
  B. Barbell portfolio
  C. Laddered portfolio

- **Correct Answer: C**

Yield Curve Strategies

126-256

Framework

1. Changes of yield curve
2. Major types Yield curve strategies
   - Stable yield curve
   - Yield curve movement
3. Implement yield curve strategies with derivatives
   - Alter duration
   - Alter convexity
4. Inter-market curve strategies
5. Evaluating yield curve trades
   - Expected return decomposition
   - The risk of yield curve moments

1. Yield curve

- **Yield curve**
  - A yield curve is a stylized representation of the yields available to investors at various maturities within a market.
- **Problems with modeling yield curve**
  - ***Unsynchronized*** observations of various maturities on the curve (non-parallel shift);
  - Gaps in maturities that require ***interpolation*** and/or smoothing;
  - Observations that seem ***inconsistent*** with neighboring values;
  - ***Differences in accounting or regulatory*** treatment of certain bonds that may make them look like ***outliers***.

Changes of yield curve

- **Parallel shift (*level*)**
  - Level: A parallel shift where all yields shift up (or down) by the same amount.
- **Change in slope – steepening/flattening (*slope*)**
  - Slope: Where the curve becomes flatter or steeper.
    - ✓ **Spread = Y_L-Y_S**
- **Change in curvature (*Curvature*)**
  - Curvature: Where the curve becomes more like a straight or curved line.
  - A common measure of yield curve curvature is the butterfly spread.
    - ✓ **Butterfly spread = $-Y_S+2\times Y_M-Y_L$**
- **Correlation of three changes**
  - Since short-term rates tend to be more volatile than long-term rates
    - ✓ Upward shift in level → flattens + less curved;
    - ✓ Downward shift in level → steepens + more curved.

Duration

- **Macaulay duration** (effective maturity)
  - Weighted average of time to receive the bond's promised payments. The present value of each payment to be received is weighted by the present value of all future payments.
- **Modified duration**
  - Direct measure of the relationship between changes in a bond's yield and percentage changes in its price. Modified duration is the Macaulay duration statistic divided by one plus the yield to maturity for each period.
- **Effective duration**
  - The sensitivity of a bond's price to a change in a benchmark yield curve. Used to describe bonds with ***embedded options***.
- **Key rate duration** (partial duration, partials)
  - Measure of a bond's sensitivity to a change in the benchmark yield curve at a specific maturity point or segment.

Duration

- **Money duration (dollar duration)**
  - Measure of the price change in units of the currency in which the bond is denominated. Money duration can be stated per 100 of par value or in terms of the bond's actual position size in the portfolio.
- **Price value of a basis point (PVBP, DV01)**
  - Estimate of the change in a bond's price given a 1 bp change in yield to maturity.

Convexity

- **Convexity (second order)**
  - Describes a bond's price behavior for larger movements in yield.
  - The expected return of a bond with positive convexity will be higher than the return of an identical-duration, lower-convexity bond if interest rates change.
- **Effective convexity**
  - Like effective duration, uses a methodology that can accommodate cash flows that change when yields change. Used to describe ***bonds with embedded options***.

2. Yield curve strategies

- **Assume yield curve is upward sloping**

Active strategies		
Stable yield curve		(1) Buy and hold
		(2) Roll down/ride the yield curve
		(3) Sell convexity
		(4) Carry trade
Yield curve movement	Level change	(1) Parallel shift
	Slope change	(2) Flattening (3) Steepening
	Curvature change	(4) Less curvature More curvature
	Rate volatility change	(5) Decrease rate volatility Increase rate volatility

2.1 Strategies for stable yield curve

- **(1) Buy and hold**
  - In an upward sloping curve, extend maturity (and therefore duration) to ***earn a higher yield and expected return***.
  - **Benefit from**:
    - ✓ coupon collection and reinvestment, indicating by higher YTM;
    - ✓ another advantage of this strategy will be low turnover and transaction costs;
  - Although hold without active trading, it is still an ***active management***, since the bond's characteristics ***diverge from the benchmark***.

2.1 Strategies for stable yield curve

- **(2) Riding (roll down) the yield curve**
  - This strategy is based on the fact that as time passes, the bond's remaining maturity and duration decrease.
  - When price is **upward sloping**, ***buy long term bonds and sell short term bonds***;
  - **Benefit from**:
    - ✓ higher gain during price appreciation and lower loss during price depreciation;
    - ✓ Then, after the yield declines, the manager sells the bond and rolls out the curve to repeat the process by buying another bond at the end of a steep segment of the curve;
  - Particularly useful when: yield curve are stable and relatively ***steep***, since the price will appreciate more as the time passes.
  - If the ***forecast ending yield*** on a particular bond is ***lower (higher) than the forward rate***, then it can be expected ***to earn a return greater than (less than) the one-period rate***.

Strategies for stable yield curve

- **(3) Sell convexity**
  - ***Buy*** bonds with ***lower convexity***, or say, ***sell*** bonds with ***higher convexity***.
    - ✓ E.g. Buy callable bonds or MBS (negative convexity).
  - **Benefit from**: difference in convexity between bonds with same duration.
- **(4) Carry trade**
  - A carry trade involves ***buying a security*** and ***financing it at a rate that is lower*** than the yield on that security;
  - **Benefit from:** In a stable upward sloping curve, borrow at lower shorter-term rates to invest at higher longer-term rates;(**the spread between two rates**)
  - The carry trade can be inherently risky, because the portfolio holds (typically) longer-term securities financed with short-term securities.

Strategies for stable yield curve

- **(4-1) Carry trade: Intra-market carry trades**
  - There are at least three basic ways to implement a carry trade to exploit a stable, upward-sloping yield curve:
    - ✓ Buy a bond and finance it in the repo market;
      - ◆ Creating an asset and a liability.
    - ✓ Received fixed and pay floating on an interest rate swap;
      - ◆ Replicates the cash flows associated with such an asset and a liability
    - ✓ Take a long position in a bond (or note) futures contract;
      - ◆ Long position in a bond (or note) futures contract actually constitutes a carry trade in and of itself
- **(4-2) Carry trade: Inter-market carry trades**

Strategies for stable yield curve

- The first two of these approaches involve explicit financing at the short end of the yield curve and explicit accrual/receipt of a higher fixed rate at the long end of the yield curve.
- A long position in futures contract actually constitutes a carry trade. With arbitrage enforcing futures price converge to the spot price at expiration, the long futures position will have implicitly earned the accrued interest on the bond and paid the financing cost.

Example

- **Exhibit 1. 6-month Horizon Return for US bonds**

	2Yr	5Yr	10Yr	30Yr
US	0.28%	0.52%	-0.05%	-1.37%

- **Exhibit 2. Modified Durations for US Government bonds**

	2Yr	5Yr	10Yr	30Yr
US	1.48	4.29	8.42	11.69

- **Identify the most attractive cash-neutral, duration-neutral trade. Set the maximum position in any bond at ±$1 million.**

Example

- **Correct Answer:**
  - In the US market, we want to find a zero-cost (i.e. cash-neutral) combination that increases return as much as possible without changing duration. Using the total returns from Exhibit 1, the potential return impact of buying/selling each maturity against each of the others is as follows:
  - **United States: Potential Change in Return from Pairwise Trades**

BUY	Sell			
	2Yr	5Yr	10Yr	30Yr
2Yr	-	-0.24%	0.33%	1.65%
5Yr	0.24%	-	0.57%	**1.89%**
10Yr	-0.33%	-0.57%	-	1.31%
30Yr	-1.65%	-1.89%	-1.31%	-

Example

- Each entry is simply the difference between the corresponding total returns in Exhibit 1. Note that the trades below the diagonal — for example, buying 5s and selling 2s — increase duration while the trades above the diagonal reduce duration. Buying 5s and selling 30s promises the biggest absolute increase in return (1.89%), though the increase is still substantial if 2s or 10s are purchased against 30s instead. Of course, we also need to consider the impact on duration. Using the durations from Exhibit 2, above, along with the total returns from Exhibit 1,we can **compute the change in return per change in duration from each potential pairwise trade.**

Example

- **United States: Change in Return/Change in Duration from Pairwise Trades**

Buy	Sell			
	2Yr	5Yr	10Yr	30Yr
2Yr	-	-0.0854%	0.0476%	0.1616%
5Yr	**0.0854%**	-	0.1380%	0.2554%
10Yr	-0.0476%	-0.1380%	-	**0.4006%**
30Yr	-0.1616%	-0.2554%	-0.4006%	-

- As an example, buying 5s and selling 2s increases return by 0.24% and increases duration by 2.81 (= 4.29 -1.48), which implies an increase in return of 0.0854% (= 0.24%/2.81) per unit of duration increase. Duration changes are always treated as positive in these ratios so that the entries in the table reflect the sign of the change in return.

Example

- While **buying 5s/selling 30s** offers the biggest absolute increase in return (1.89%), **buying 10s/selling 30s** offers the biggest increase per unit of duration (0.4037%).
- ***Either one reduces duration, so it will have to be combined with a trade that increases duration by the same amount.***
- **Buying 5s/selling 30s** would be combined with **buying 10s/selling 2s**，which decreases returns, by – 0.0476% per unit of duration.
- **Buying 10s/selling 30s** would be combined with **buying 5s/selling 2s**, which increases return by 0.0354% per unit of duration. Consider each trade:

Example

- **Buy 10s/Sell 30s and Buy 5s/Sell 2s**
  - Buying $1 million 10s and selling $1 million 30s reduces duration by 3.27 (8.42 -11.69 = -3.27). Buying $1 million 5s and selling $1 million 2s increases duration by 2.81 (= 4.29- 1.43), which is not enough to offset the 10s/30s position. Due to the limitation of trades to ± $1 million sizes, we cannot do a bigger 5s/2s trade, so we would have to reduce the size of the 10s/30s position to $0.8593 million (= 2.81/3.27) instead. The increase in return for this combination of trades would be
  - (0.8593 * 1.31%) + 0.24% = 1.3657%

Example

- **Buy 5s/Sell 30s and Buy 10s/Sell 2s**
  - Buying $1 million 5s and selling $1 million 30s reduces duration by 7.40 (4.29 -11.69 = -7.40). Buying $1 million 10s and selling $1 million 2s increases duration by 6.94 (= 8.42 - 1.48), which is not enough to offset the 5s/30s position. Since we cannot do a bigger 10s/2s trade, we would have to reduce the size of the 5s/30s position to $0.9378 million (= 6.94/7.40) instead. The increase in return for this combination of trades would be
  - (0.9378 * 1.89%) + (-0.33%) = 1.4424%
- **The combination of *buying 5s/selling 30s and buying 10s/selling 2s* offers a bigger increase in return and is therefore the *best trade* in the US market.**
  - There is a **third possibility: Buy 2s/Sell 30s and Buy l0s/Sell 5s**. The reader can confirm that this combination of trades does not give a better result.

2.2 Strategies for yield curve movement

就情况二yield curve movement，进行概述性探讨

- **(1) Duration management (parallel)**
  - If rates are expected to increase, decrease portfolio duration before this occurs to minimize the value lost.
  - If rates are expected to decrease, increase portfolio duration before this occurs to maximize the value gained.
    - ✓ Of course all changes in duration must be consistent with the portfolio constraints.
  - Formula: $\frac{\Delta P}{P} \approx -D \times \Delta Y$ (in percentage points)
  - **If our forecast yield changes were large**, incorporate convexity measures.

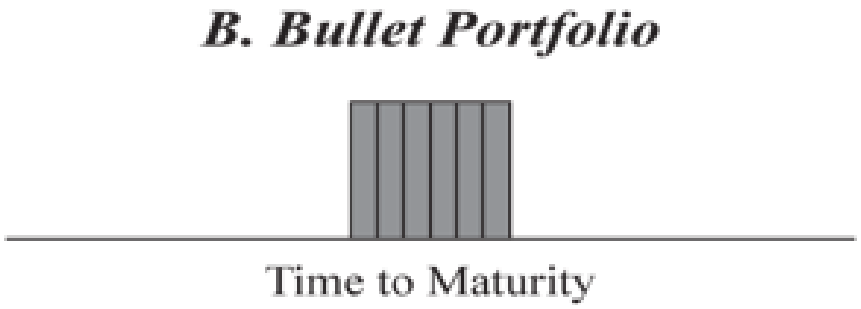
2.2 Strategies for yield curve movement

就情况二yield curve movement，进行概述性探讨

- **(2) Buy convexity**
  - **Benefit from**: higher volatile or short period of changes in yield curve.
    - ✓ The convexity will magnify value gain when rates decrease and cushion price loss when rates increase.
  - Methods
    - ✓ Alter portfolio structure (指运用含权债券)
      - ◆Modest effect, since managers may impede by illiquidity.
    - ✓ Buy call option on bond
      - ◆Effective at adding convexity to a portfolio.
  - The convexity effect will only be material if the rate change is significant and it will involve accepting less yield (assuming rational pricing of assets in the market).
- **(3) Barbell and bullet strategies (non-parallel) (见下一页)**

Bullet and barbell strategies

- **Barbell and bullet strategies (non-parallel)**
  - **Bullet portfolio:** targeting a ***single segment of the curve***, lower dispersion of cash flows, ***lower convexity***.



  - **Barbell portfolio:** combining securities ***concentrated in short and long maturities***, higher dispersion of CF, ***higher convexity***.

Reasons and methods to alter convexity

- **Reasons**
  - When a portfolio manager is operating under very ***tight duration constraints***, convexity can be an important portfolio management tool.
  - Deal with ***non-parallel shifts*** in yield curve.
- **Limitations**
  - The decline in rates must occur in short-term. Since higher convexity results in lower yield, if the yield change unfolds over too long a period, the yield sacrificed will be larger than the expected price effect.
- **Methods**
  - The most direct way to do this is to add instruments that have a lot of curvature in their price response to yield changes.
    - ✓ E.g. call option on bond.

Method to alter convexity

- **The method for increasing convexity (keeping duration-neutral):**
  - **Use pure bonds:**
    - ✓ Long bond with high convexity
    - ✓ Short bond with low convexity
  - **Use bonds with embedded option:**
    - ✓ Long putable bond
    - ✓ Short callable bond / MBS
  - **Use bond portfolios:**
    - ✓ Long barbell
    - ✓ Short bullet
  - **Use options:**
    - ✓ Long call on bond OR long put on bond

Level change

- **(1-1) Parallel upward shift:** duration positioning
  - **(1) Choose the bond with *highest total return***
    - ✓ Total return ≈ −1 × **Ending** effective duration × (YTM_E – YTM_B) + YTM_B
    - ✓ Implied forward yield change > the forecasted increase in yield → return higher than the one-year rate if the forecast rates are realized.

Example

- Hillary Lloyd is a portfolio manager at AusBank. Her benchmark had an effective duration of 2.00 with tolerant fluctuation of ±0.30 year. Her current portfolio of annual coupon-paying bonds is shown as below. Lloyd is highly confident that yields will increase by 60 bps across the curve in the next 12 months.

  Select which securities to sell and which ones to buy to maximize her return during the next year while staying within her portfolio constraint.

Maturity	Coupon	P	YTM	V_{mkt}	wi%	ED_B	ED_E
1 Year	1.50	100	1.50	5,000	5%	0.985	0.000
2 Year	1.91	100	1.91	65,000	65%	1.944	0.979
3 Year	2.23	100	2.23	24,000	24%	2.871	1.930
4 Year	2.50	100	2.50	3,000	3%	3.762	2.846
5 Year	2.74	100	2.74	2,000	2%	4.614	3.726
6 Year	2.95	100	2.95	1,000	1%	5.426	4.566
Portfolio	2.01%		2.01%	100,000	100%	2.261	1.305

Example

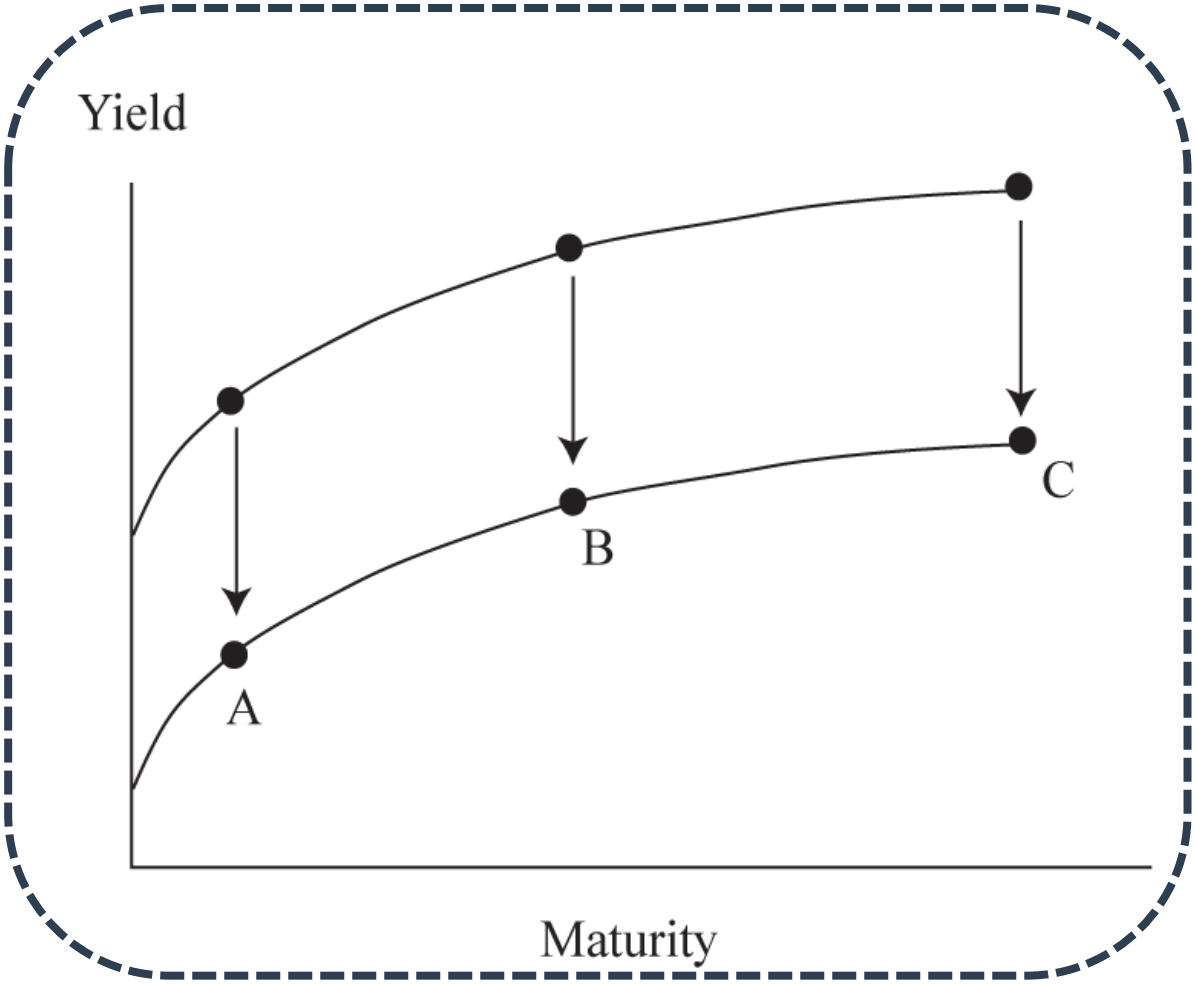
➢ **Correct answer:** -1*0.979* [(1.5 + 0.6)-1.91] +1.91 = 1.72%

Security Descriptor (all are par bonds)			**Next 12-month stable curve**		**Next 12-Month +60 bps**	
Maturity	Coupon	P0	P1	HPR	E(i)	HPR
1 Year	1.50%	100	100.00	1.50%	2.10%	1.50%
2 Year	1.91%	100	100.40	2.31%	2.51%	1.72%
3 Year	2.23%	100	100.62	2.85%	2.83%	1.69%
4 Year	2.50%	100	100.78	3.28%	3.10%	1.56%
5 Year	2.74%	100	100.90	3.64%	3.34%	1.41%
6 Year	2.95%	100	100.97	3.92%	3.55%	1.18%

Choose 2-year bond with highest total return. The effective duration of new portfolio will be 1.944 (ED_B) within the range of 2±0.30.

Level change

- **(1-2) Downward parallel shift**



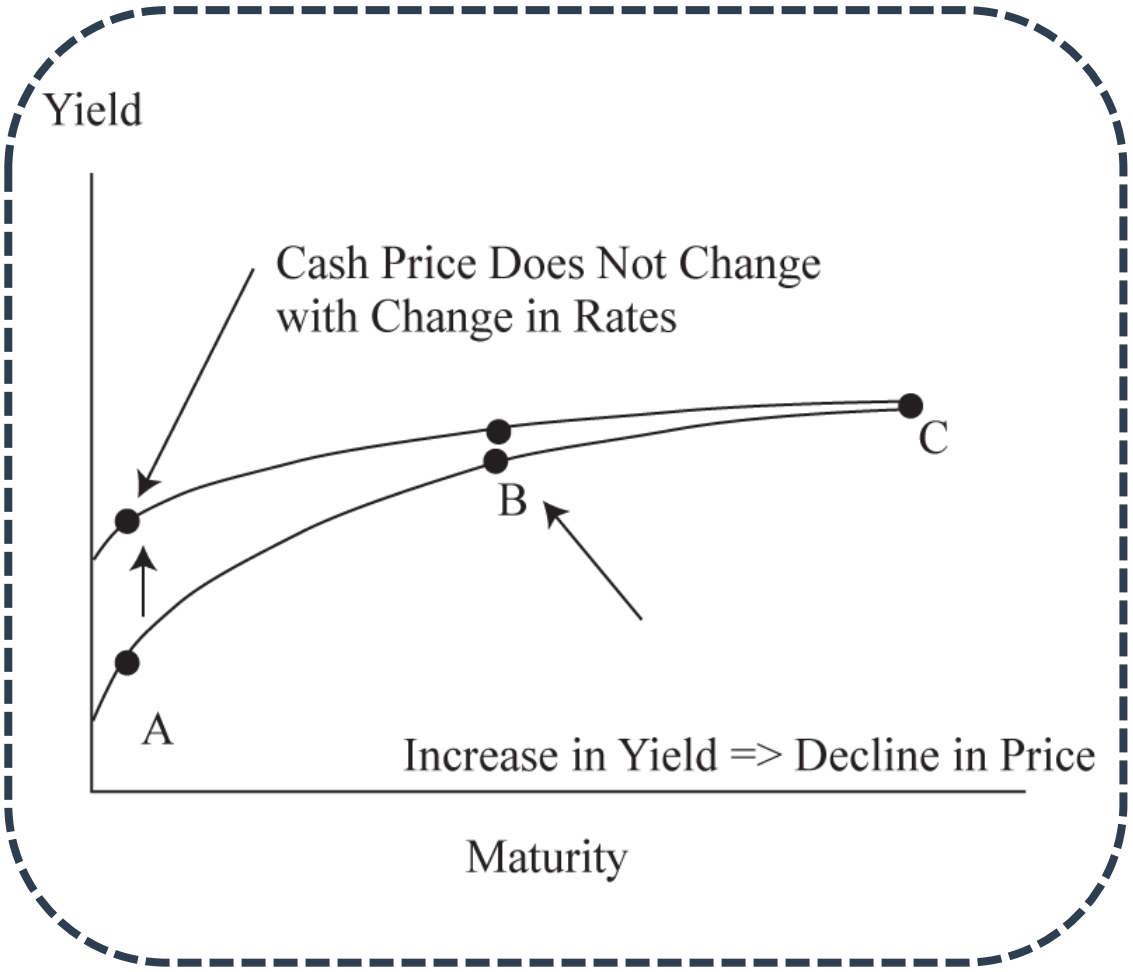
(2) Alter convexity

The ***higher-convexity barbell*** **portfolio AC will outperform** ***bullet*** **portfolio B.**

- AC has greater sensitivity to declining yields and hence will increase more in prices.

Slope change

- **(2-1) A Flattening of the Yield Curve: Short Rates Rise**

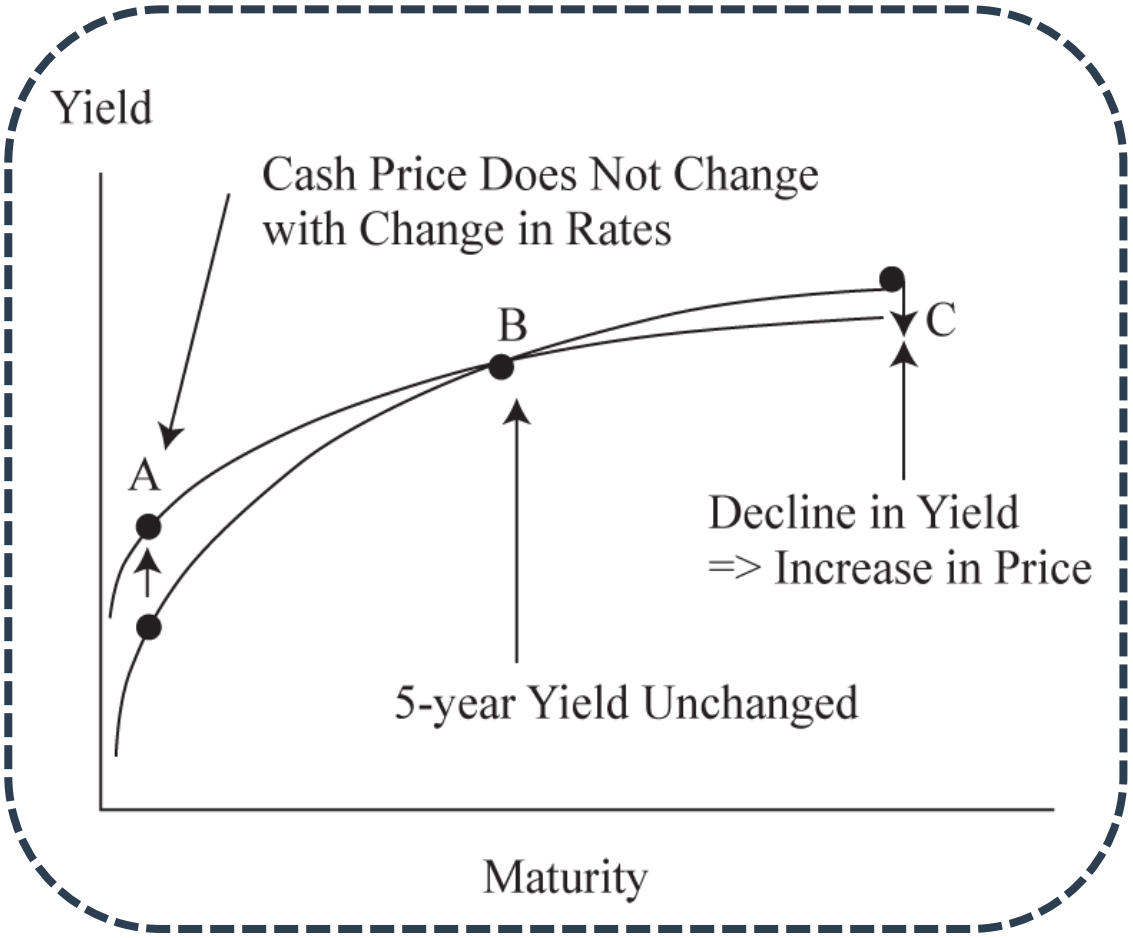


The *barbell* portfolio AC *outperforms* the *bullet* portfolio B. *Increase convexity.*

- Bond A does not decline in value given its duration of near zero.
- Bond C does not change in value because its yield does not change.
- Portfolio B loses money, however, because the yield on position B (the five-year notes) rises.

Slope change

- **(2-2) A Flattening of the Yield Curve: Short Rates Rise and Long Rates Fall**

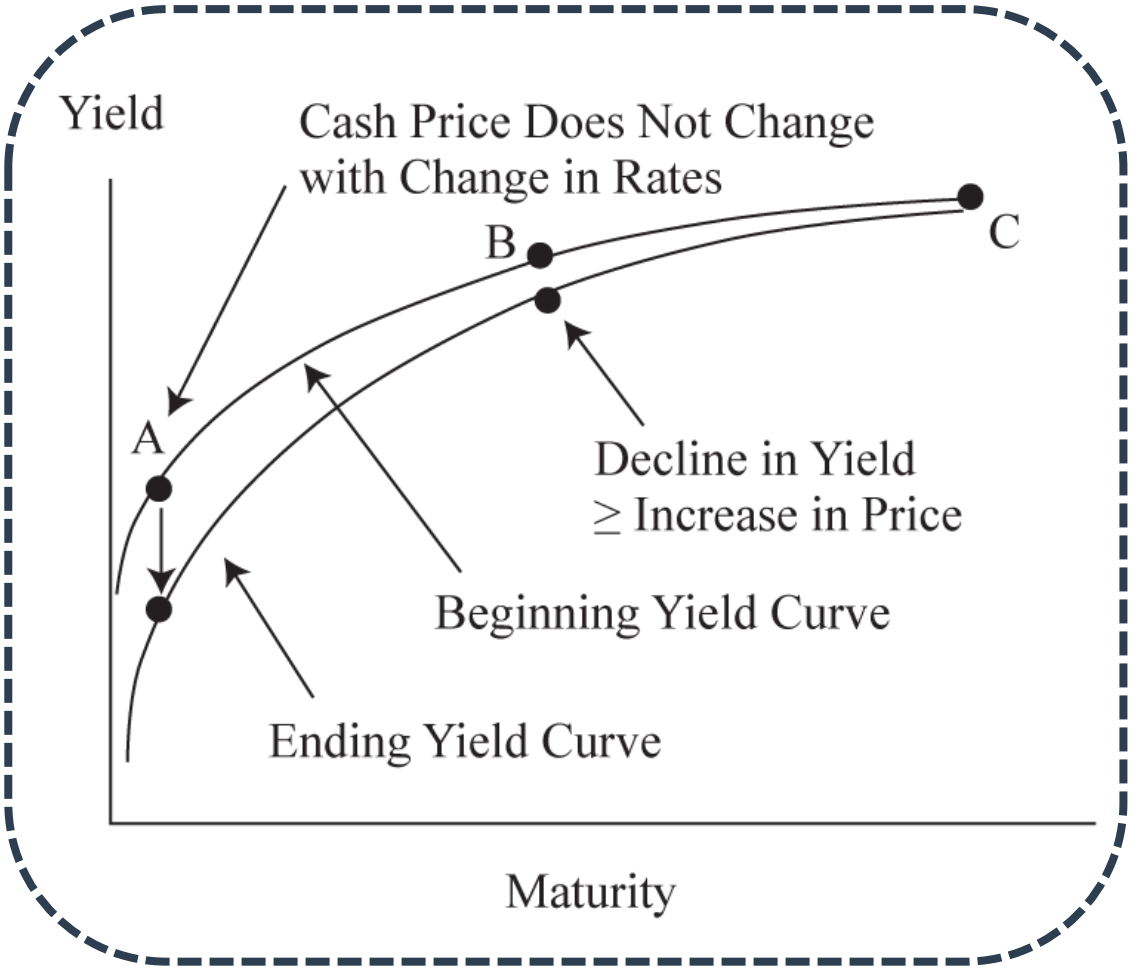


The *barbell* portfolio AC *outperforms* the *bullet* portfolio B. *Increase convexity.*

- The price of Bond B is unaffected because the bond's yield is constant.
- The price of Bond A is unchanged given its zero (cash-like) duration.
- The price of Bond C increases as the bond's yield declines.

Slope change

- **(3-1) A steepening of the yield curve: short and intermediate rates fall**

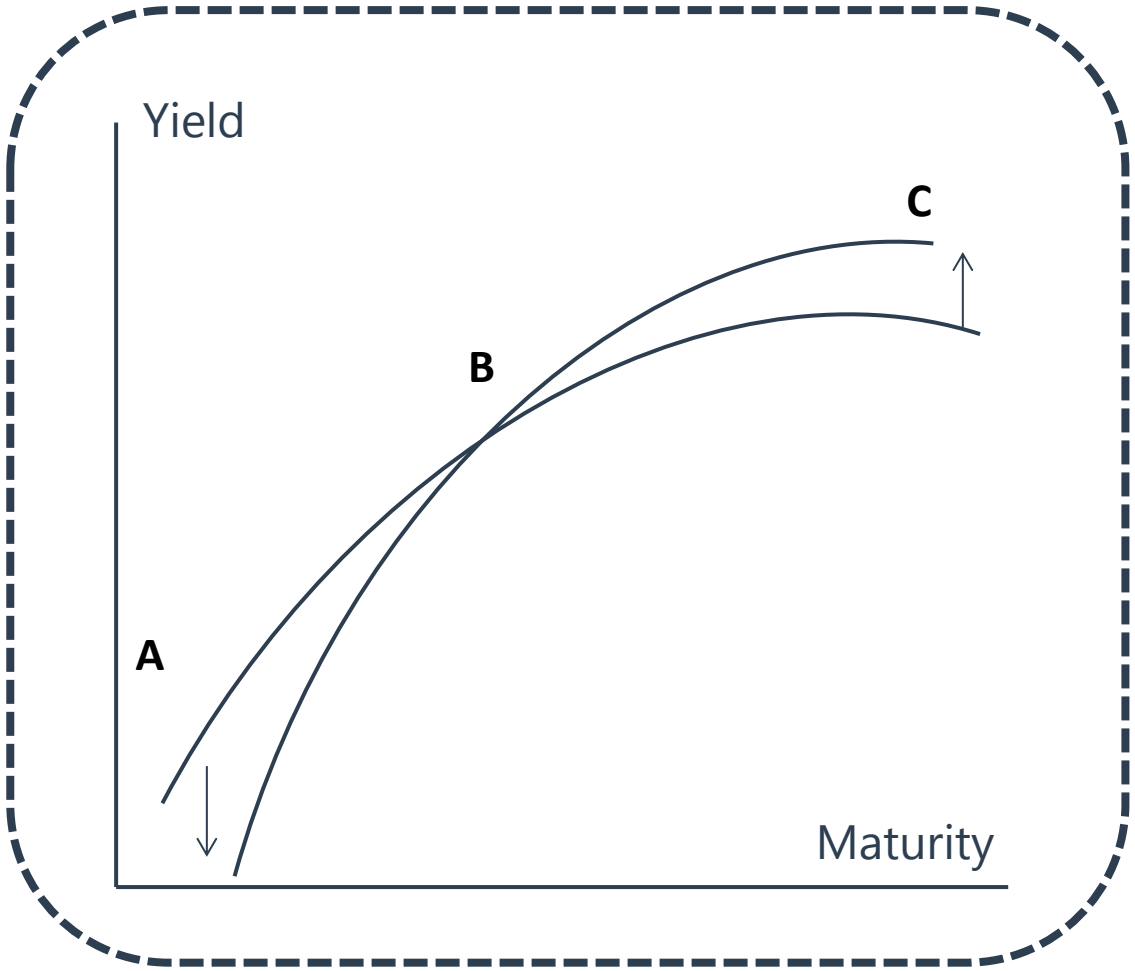


Bullet* portfolio B *outperforms barbell* Portfolio AC. *Decrease convexity.

- Bonds A and C experience no change in price
- While bond B increases in value.

Slope change

- **(3-2) A steepening of the yield curve**



Bullet **portfolio B**

outperforms barbell

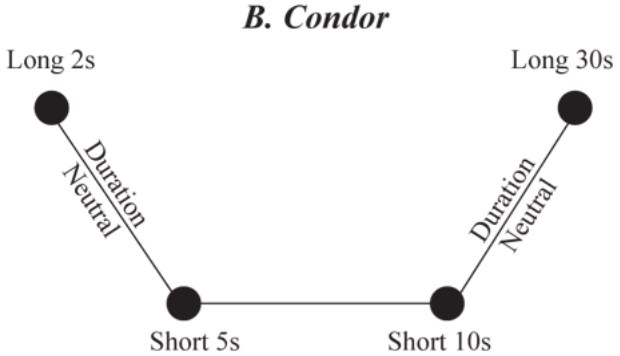
Portfolio AC.

Decrease convexity.

Curvature change

- **(4) Condor 曲度变化**
  - If a manager expect that the **short end of the curve steepens while the long end of the curve flattens.** → Strategy with money duration neutral.
    - ✓ Long the 2-year note and short the 5-year note;
    - ✓ Short the 10-year note and long the 30-year bond.

    Long barbell, short bullet
  - Profit if the yield curve adds curvature.



- **More curvature**: ***barbell portfolio outperforms*** bullet portfolio. ***Increase convexity.***
- **Less curvature**: ***bullet portfolio outperforms*** barbell portfolio. ***Decrease convexity.***

Rate volatility change

- **(5) Change in interest rates, direction uncertain:**
  - **When the volatility of interest increases,**
    - ✓ Match effective duration with benchmark;
    - ✓ ***Increase the convexity*** of the portfolio by altering portfolio structure to get dispersed maturities ***(long barbell, short bullet)***.
  - **When the volatility of interest decreases**
    - ✓ Match effective duration with benchmark;
    - ✓ ***Decrease the convexity*** of the portfolio to gain higher yield by altering portfolio structure to get concentrated maturities ***(long bullet, short barbell)***.

Example

- Stephanie Joenk manages the emerging markets government bond portfolio for a major German bank. The investment mandate requires that the **portfolio's effective duration match that of benchmark**, the Bloomberg Emerging Market Sovereign Bond Index. She expects Brazilian interest rates to be **extremely volatile** in the coming year, given the pending federal government elections. Based on her bank's internal economic forecasts and her own analysis, she expects that **rates will move by 250 bps in the year ahead, although the direction of change will depend on the outcome of the elections.** Joenk currently **holds a Brazilian 10-year bond** with a duration that, combined with the other positions in her portfolio, keeps the effective duration aligned with the benchmark. Other securities that are readily **available in the market include 6-month bills as well as 3-year notes and 30-year bonds**.

Example

- Brazilian Government Notes and Bonds

Security	Coupon	Price	YTM	Effective Duration	Effective Convexity
6 month	6.000	102.70	1.110	0.538	0.006
3 year	8.875	119.75	2.599	2.895	0.105
10 year	6.000	104.80	5.361	7.109	0.666
30 year	5.000	82.50	6.332	13.431	2.827

- How can Joenk profit from his anticipation?
- Calculate the weighted invested in each subgroups respectively.
- Calculate gains or losses from the changes in positions.

Example

➢ **Correct Answer:**

Profit from **adding convexity** while matching duration.

		Duration	Convexity
Sell:	Brazil 10 year	7.109	0.666
Buy:	Brazil 3 year	2.895	0.105
	Brazil 30 year	13.431	2.827

- To maintain the effective duration match:

  Suppose the weight of 3-year note is x.

  $7.109=2.895x+13.431(1-x)$ Solving for x, we find $x = 0.60$

  The proceeds from the sale of the 10-year note should be allocated 60% to the 3-year note and 40% to the 30-year bond.

Example

- **Correct Answer (cont.):**
  - The gain in convexity:

(60% × 0.105) + (40% × 2.827) – (100% × 0.666) = 0.528

The give-up in yield will be –127 bps:

(60% × 2.599%) + (40% × 6.332%) – (100% × 5.361%) = –0.127 or –1.27%

  - If the forecast change in rates does not materialize, the "yield drag" will cause the returns of **the higher-convexity portfolio to be less than that of the initial portfolio with its lower convexity**.

Strategies for yield curve movement

- **Change in yield curve:**
  - **Duration-neutral**
    - ✓ ***Unchanged effective duration*** with changing bond structure.
  - **Barbell vs. bullets**
    - ✓ **Barbell portfolios**, given the location of their bonds along the curve, ***outperform*** bullet portfolios if the yield curve ***flattens and become more volatile***.
    - ✓ **Bullet portfolios *outperform*** barbell portfolios if the yield curve ***steepens and become stable***.

Strategies for yield curve movement

- **Butterflies (barbell + bullet)**
  - **Long**
    - ✓ ***Long wings (barbell) and short body (bullet)***
    - ✓ ***Positive convexity***, buying convexity: long higher convexity (barbell), short lower convexity (bullet)
    - ✓ **Benefit from *flat, and volatile yield curve***
  - **Short**
    - ✓ ***Short wings (barbell) and long body (bullet)***
    - ✓ ***Negative convexity***, selling convexity
    - ✓ **Benefit from *steep, and stable yield curve***

Strategies for yield curve movement

- **Methods to construct butterflies (barbell + bullet)**
  - **Duration neutral selects the weights so that**
    - ✓ Duration of the wings equals the duration of the body;
    - ✓ Market values are also the same;
    - ✓ Thus, the positions are also ***money duration neutral***.
  - **50/50**
    - ✓ ***Shorting the body*** and allocating the proceeds of the short sale to the wings such that half the duration value (market value multiplied by modified duration) is allocated to each wing of the barbell portfolio. ***50% to long end*** and ***50% to short end*** of the curve respectively.
  - **Regression weighting**
    - ✓ The weights assigned to each wing of the barbell portfolio is determined by regression analysis with short-term data, typically 30 to 45 days.

Summary

情况一 **Stable yield curve**	Buy and hold
	Roll down/ride the yield curve
	Sell convexity
	Carry trade

Yield Curve Scenario		**Barbell**	**Bullet**
Level change	(1) Parallel shift	Outperforms	Underperforms
Slope change	(2) Flattening	Outperforms	Underperforms
	(3) Steepening	Underperforms	Outperforms
Curvature change (4)	Less curvature	Underperforms	Outperforms
	More curvature	Outperforms	Underperforms
Rate volatility change (5)	Decreased rate volatility	Underperforms	Outperforms
	Increased rate volatility	Outperforms	Underperforms

3. Derivatives used to implement strategies

- **(1) Duration management**
  - Leverage buy bonds
  - Futures;
  - Options;
  - Swap
  - Swaptions.

$$\text{PVBP} = \frac{\text{NP} \times \text{D}_{\text{mod}}}{100} \times 0.01$$

$$\text{Required additional PVBP} = \text{Target PVBP} - \text{old PVBP}$$

$$\text{Number of contracts required} = \frac{\text{Required additioanl PVBP}}{\text{PVBP of the futures contract}}$$

$$\text{Effective portfolio duration} \approx \frac{\text{Notional portfolio value}}{\text{Portfolio equity}} \times \text{Duration}$$

Duration for an option

补充参考

- Most interest rate options are written on interest rate futures contracts, rather than on a debt security. In a call option written on a futures contract, the buyer has the right to buy the futures contract at the strike price. If exercised, the seller would take a short position in the futures contract.

  D for an option = delta * D of underlying * leverage

  Leverage = (price of underlying /price of option)

- In a put option written on a Treasury futures contract, the buyer has the right to sell the futures contract at the strike price.

$$\Delta P = D * P * \Delta y$$

$$\Delta P_{option} = Delta * \Delta P = Delta * D * P * \Delta y \text{ devided by } P_{option}$$

$$\frac{\Delta P_{option}}{P_{option}} = Delta * D * \Delta y \frac{P}{P_{option}} = Delta * D * \Delta y * leverage$$

$$\frac{\Delta P_{option} / P_{option}}{\Delta y} = Delta * D * leverage$$

Example

- A manager wants to increase the duration of a portfolio with $10 million market value and a duration of 6 to a duration of 7. Three methods can be used.
  - Use US Treasury 10-year note futures contract with a PVBP of $85.
  - Use leverage to purchase bonds with same duration of 6.
  - Use interest rate swaps (all versus three-month LIBOR).

Maturity	Effective PVBP Fixed	Effective PVBP Floating	Net Effective PVBP	PVBP per Million
5-Year	0.0485	0.0025	0.0460	460
10-Year	0.0933	0.0025	0.0908	908
20-Year	0.1701	0.0025	0.1676	1,676

How can the manager use each of the methods to reach this target duration?

Example

- **Correct answer:**

  PVBP = 10 million × 6 / 10,000 = $6,000

  PVBP target = 10 million × 7/10,000 = $7,000

  Required additional PVBP = 7,000-6,000=$1,000

  Namely, increasing duration is equivalent to adding additional PVBP of $1,000.

  - **Method 1**

    Number of contracts required = Required additional PVBP / PVBP of futures contract = 1000/85 = 11.76 ≈ 12 contracts

  - **Method 2**

    7/6=1.167, purchase more bonds 16.7%*10million = 1.67 million (market value of similar bonds with a duration of 6).

Example

- **Correct answer (cont.):**
  - **Method 3**

Maturity	Effective PVBP Fixed	Effective PVBP Floating	Net Effective PVBP	PVBP per Million
5-Year	0.0485	0.0025	0.0460	460
10-Year	0.0933	0.0025	0.0908	908
20-Year	0.1701	0.0025	0.1676	1,676

✓ Using five-year swaps, we would need to add 1,000/460 or $2.17 million in swaps.

✓ Using 10-year swaps, we would need to add 1,000/908 or $1.1 million in swaps.

✓ Using 20-year swaps, we would need to add 1,000/1,676 or $0.60 million in swaps.

Example

- **Duration management**
  - Slight difference between the face value of 10-year note futures (1.2 million method 1) and the 10-year swaps ($1.1 million) arises because the futures contract was tracking a "***cheapest to deliver***" that is slightly shorter than the 10-year note.
  - 20-year swaps have more volatility than the 10-year swaps, so a lower face amount would be needed for the same exposure.

Derivatives used to implement strategies

- **(2) Alter convexity**
  - Use short-maturity at– or near-the-money options with higher convexity.
  - Because the convexity of bonds with shorter maturities is relatively small, it is hard **to add convexity** to a portfolio without buying longer-maturity securities.
  - Add convexity: long options.
  - Reduce convexity: short options.

Evaluate sensitivity with key rate duration

- **Key rate duration**
  - KRDs can be used to estimate a bond's sensitivity to ***changes in the shape of the benchmark yield curve***.
  - Key points on the yield curve: 2-year, 5-year, 7-year, 10-year and 30-year maturities.
  - The ***sum of the KRDs*** must ***closely approximate the effective duration***.
  - Identify barbell and bullet: the higher key rate duration, the higher exposure to that maturity.
    - ✓ **Barbell:** higher key rate duration at long-term and short-term bonds;
    - ✓ **Bullet:** higher key rate duration at intermediate-term bonds.
- **Partial PVBP (partial DV01):**
  - Measure the change in dollar value of per 100 par bond when part of the yield curve changes for 1 bps.
- **Predicted change = Portfolio par amount × Partial PVBP × (–Curve shift) × 100**

4. Inter-market curve strategies

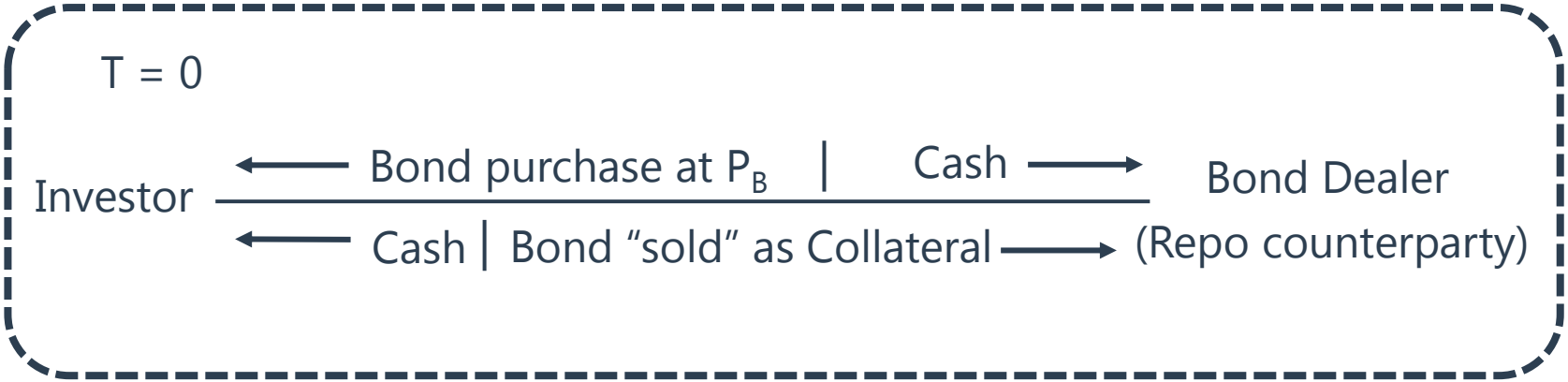
- **Inter-market trades** involve ***more than one yield curve*** and require the investor to either accept or somehow hedge ***currency risk***.
  - Simply making an investment outside one's home market should be viewed as an inter-market trade since it reflects a judgment that the foreign position is more attractive than alternatives at home.
- The **primary driver** of inter-market trades is a ***view on narrowing or widening of yield spreads between markets***.
  - Inter-market carry trades may or may not involve a duration mismatch.
- **Under what conditions would two markets share a yield curve? (Convergence trade)**
  - First, there must be ***perfect capital mobility*** between the markets, ensuring that risk-adjusted expected returns will be equalized.
  - The second condition is more onerous: the ***exchange rate*** between the currencies must be credibly ***fixed***.

Inter-market curve strategies

- **Inter-market carry trades:**
  - Implement an inter-market carry trade **subject to currency exposure**, the inter-market carry trade simply involves ***borrowing in the low interest rate currency and lending in the high interest rate currency***. Among the ways to implement such a trade are the following:
    1. ***Borrow*** from a bank in the ***lower rate currency***, ***convert*** the proceeds ***to the higher rate currency***, and ***invest in a bond*** denominated in that currency. **(calculate carry trade return)**
    2. Enter into a **currency swap**, receiving payments in the higher rate currency and making payments in the lower rate currency.
    3. Borrow in the higher rate currency, invest the proceeds in an instrument denominated in that currency, and convert the financing position to the lower rate currency via the FX forward market (buy the higher rate currency forward versus the lower rate currency).

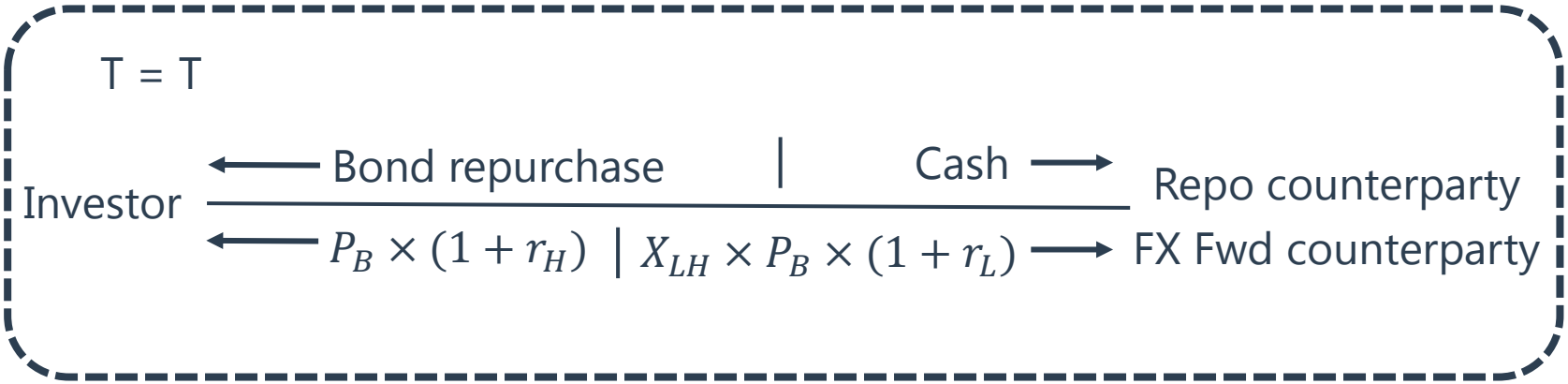
Inter-market carry trades

- **The third approach, cross-currency aspect is introduced via the FX forward position rather than by explicit borrowing in the lower rate currency**
  - At the start of the period, the investor buys a bond denominated in the higher yielding currency from dealer and concurrently "sells" it to a repo counterparty, and promising to repurchase in the future at a pre-determined price.



Inter-market carry trades

- **Inter-market carry trades**
  - ✓ The investor also executes a currency forward contract agreeing to pay $[X_{LH} \times P_B \times (1 + r_L)]$ units of the lower interest rate currency at expiration in return for receiving $[P_B \times (1 + rH)]$ units of the higher interest rate currency.
  - ✓ (P_B:the price paid for the bond, X_{LH}: the initial spot exchange rate LC/HC, r_H and r_L: the respective higher and lower interest rates)
  - ✓ This forward contract implicitly entails borrowing $X_{LH} \times P_B$ at rate r_L and lending P_B at rate r_H.



Example

- **Exhibit 1. Sovereign Yields in Three Markets**

	Floating	Fixed Rate with Semi-annual Payments		
	6m Libor	1yr	3yr	5yr
Euro	0.15%	0.25%	0.40%	0.60%
UK	0.50%	0.70%	0.95%	1.10%
US	1.40%	1.55%	1.80%	1.95%

- Winslow expects yields in the US, Euro, and UK markets to remain stable over the next six months. Meanwhile, she projects that the US Dollar will depreciate by 1% against the Euro, and the British Pound will remain stable versus the Euro.
- Winslow is looking at carry trades, with or without taking currency exposure, among her three base currency markets. Each such trade will involve extending duration (e.g., lend long/borrow short) in no more than one market.

Example

- Among the carry trades available in the US, Euro, and UK markets, determine the highest expected return for the USD-denominated portfolio over the next 6 months.
- **Correct Answer:**
  - **The highest potential return, 0.85%**, reflects ***borrowing USD for 6 months and buying the UK 5-year bond***. **The carry component of the expected return is actually a loss of 0.15% [= (1.10% - 1.40%)/2]**, but this is more than **offset by the 1% expected appreciation of GBP versus USD**.
  - A much higher carry component +0.90% = (1.95% - 0.15%)/2 could be obtained by borrowing for 6 months in EUR to buy the US 5-year note, but that advantage would be more than offset by the expected 1% loss from depreciation of the USD (long) against the Euro (short).

Inter-market curve strategies

- **Inter-market carry trades**
  - In order to eliminate currency exposure in an inter-market trade, the investor must explicitly or implicitly both borrow and lend in each currency.
  - To explore differences in the slopes of the two yields curves rather than the difference in overall rate levels.
  - Assuming normal upward sloping yield curves, is to lend at the long end and borrow at the short end on the relatively steep curve, and to lend at the short end and borrow at the long end on the relatively flat curve:
    - ✓ ***Receive fixed/pay floating in the steeper market*** and ***pay fixed/receive floating in the flatter market***. **(yield curve strategy)**
    - ✓ Take a long position in bond (or note) futures in the steeper market and a short futures position in the flatter market.

Inter-market curve strategies

- **Whether or not to actually hedge** the currency exposure depends on if the ***cost/benefit of hedging is greater than the projected change in the spot exchange rate***.
  - For example:
    - ✓ For one dollar-denominated portfolio, hedging the Greek bond into USD would "pick up" 0.625% (hedge benefit). But EUR is expected to appreciate by 1.0% against the dollar, so it is better to leave the bond unhedged in the USD-denominated portfolio.
    - ✓ Hedging EUR into GBP picks up 0.175% of return (hedge benefit). Since EUR is projected to remain unchanged against GBP, it is better (from an expected return perspective) to hedge the Greek bond into GBP.

Covered Interest rate parity

- **Covered Interest rate parity (IRP)**
  - Covered interest rate parity is based on an arbitrage relationship among risk-free interest rates and spot and forward exchange rates.
  - When currencies are freely traded and ***forward contracts*** are available in the marketplace, interest rate parity must hold.
  - F (forward), S (spot) X/Y, r_X and r_Y is the nominal risk-free rate in X and Y

$$\frac{F}{S} = \frac{1+r_X}{1+r_Y}$$

$$\frac{F-S}{S} = \frac{1+r_X}{1+r_Y} - 1 = \frac{r_X - r_Y}{1+r_Y} \approx r_X - r_Y$$

Inter-market curve strategies

- **Inter-market asset decisions** should be made on the basis of prospective ***currency-hedged returns*** (based on forward FX rates rather than projected spot FX rates).

$$\textit{hedged return} = \textit{bond's local market return} + \textit{hedge cost/benefit}$$

  - By definition, ***local market returns*** are denominated in different currencies and hence are ***not comparable***.
  - ***Unhedged returns***, converted at the spot FX rate but not hedged into a common currency using the forward FX rate, are ***not comparable*** either. These unhedged returns entail differential currency risks and do not reflect the cost or benefit of removing those risks.
  - When all assets are hedged into a common currency, the portfolio's base currency becomes irrelevant for inter-market decisions. The best assets are the best assets regardless of one's base currency.

Example

- **Exhibit 1. Local Currency 6-Month Horizon Return for US, UK and German Bonds**

	2Yr	5Yr	10Yr	30Yr
US	0.28%	0.52%	-0.05%	-1.37%
UK	-0.30%	0.05%	0.55%	-0.24%
Germany	-1.51%	-2.58%	-0.70%	0.63%

- **Exhibit 2. Spot and Forward Exchange Rates for EUR and GBP vs. USD**

	Spot Rate	6-Month Forward Rate
USD per EUR	1.0998	1.1091
USD per GBP	1.2982	1.3045

Example

- **Calculate hedged returns in US dollars for UK and German bonds.**
- **Correct Answer:**
  - The local currency returns given above are not directly comparable. To make them comparable, the UK and German returns need to be hedged into US dollars.
  - Buying the GBP at the spot FX rate and selling it at the six-month forward FX rate generates a gain of **0.49% (= 1.3045/1.2932- 1)**.
  - For the EUR, the pickup is **0.85% (= 1.1091/1.0998 -1)**.
  - ***Hedged returns in US dollars are determined by adding these gains to the respective local market returns.***
    - ✓ For example, the UK 10-year return hedged into US dollars is **1.04% (= 0.55% + 0.49%)**.
  - Exhibit 3 presents the local currency returns hedged into US dollars.

Example

- **Exhibit 3. Hedged Returns in US Dollars for UK and German Bonds**

	2Yr	5Yr	10Yr	30Yr
US	0.28%	0.52%	-0.05%	-1.37%
UK	0.19%	0.54%	1.04%	0.25%
Germany	-0.66%	1.73%	0.15%	1.48%

- Taking account of the currency hedge makes both foreign markets more attractive, although the short end of the German market is still projected to generate substantial losses.
- Since yield curves are not perfectly correlated across markets, currency hedging does not eliminate the opportunity to add value via inter-market trades.

5. Evaluating yield curve trades

- **Evaluate the expected return** of different strategies to analyze the performance of each strategy.
  - **Formula**

    E(R) ≈ Yield income + Roll down return + E(ΔP) − E(Credit losses) + E(Currency G/L)

    ✓ Yield income = Annual coupon payment ÷ Current bond price

    ✓ Rolldown return = (Bond price End-of-horizon – Bond price Beginning-of-horizon) / Bond price Beginning-of-horizon

    ✓ Yield income + Rolldown return = Rolling yield

    ✓ $E(\Delta P)$ = E(Change in price based on yield view) = $[-MD_{eh} \times \Delta Yield] + [\frac{1}{2} \times Convexity \times (\Delta Yield)^2]$

    ✓ E(credit losses) = P (default) × LGD (Loss given default)

    ✓ E(Currency G/L) given

Example

- Lamont Cranston is a trader on the government securities desk of a US investment bank. He has a view on interest rates and thinks the US Treasury security zero-coupon yield curve will experience an **upward shift by 50 bps** in the next 12 months. Cranston is considering two strategies for the year ahead: a bullet portfolio and a barbell portfolio. The **bullet portfolio** would have 100% of its funds invested in **five-year Treasury zero-coupon notes**, currently priced at 94.5392. The **barbell portfolio** would have **62.97%** of its funds invested in t**wo-year Treasury zero-coupon notes**, priced at 98.7816, and the remaining **37.03%** of funds invested in **10-year Treasury zero-coupon bonds**, priced at 83.7906.

Example

- Other relevant assumptions

	Bullet	Barbell
Investment horizon (years)	1.0	1.0
Average bond price for portfolio currently	94.5392	92.6437
Average bond price for portfolio in one year (assuming stable yield curve)	96.0503	94.3525
Current modified duration for portfolio	4.97	4.93
Expected effective duration for portfolio (at the horizon)	**3.98**	**3.98**
Expected convexity for portfolio (at the horizon)*	17.82	32.57
Expected change in US Treasury zero-coupon yield curve	0.50%	0.50%

Example

- **Correct Answer:**

  Rolldown return

  Bullet: (96.0503 – 94.53922)/94.5392 = 1.5984%

  Barbell: (94.3525 – 92.6437)/92.6437 = 1.8444%

  Expected loss from increase in rates

  Bullet: $(-3.98\times0.005)+(0.5\times17.82\times0.005^2)=-1.9677\%$

  Barbell: $(-3.98\times0.005)+(0.5\times32.57\times0.005^2)=-1.9493\%$

Return Component	Portfolio Performance	
	Bullet	Barbell
Yield income	0	0
+ Rolldown return	= 1.5984%	= 1.8444%
= Rolling yield	= 1.5984%	= 1.8444%
+ E(Change in price based on yield view)	= –1.9677%	= –1.9493%
= Total expected return	= –0.3693%	= –0.1049%

Evaluating yield curve trades

- **Risk** is not about what is expected to happen; rather, it is about **deviations from the expected**.
  - The direct impact of ***deviations from the investor's views with respect to the yield curve***.
- Most of the **yield curve risk** can be adequately captured by a small set of **standard scenarios**:
  - **Shift: non-parallel level change, *82%***
  - **Twist: slope change, *12%***
  - **Butterfly: curvature change, *4%***
    - ✓ Together, they account for 98% of the weekly changes in these yields. Each of the curves reflects a one standard deviation move of that type.

Reading 21

Fixed-Income Active Management: Credit strategies

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Framework

1. Investment-grade and high-yield corporate bond portfolios
2. Credit spreads
   - Credit spread measures
   - Excess return
3. Credit strategy approaches
   - The bottom-up approach
   - The top-down approach
4. Liquidity risk and tail risk
5. International credit market
6. Structured financial instruments
   - MBS/ABS/CDO/Covered bond

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1. Credit risk

- It is prudent for **investment-grade** and **high-yield** credit portfolio managers to be aware of
  - ***spread risk*** and ***default risk***;
  - ***spread duration–based*** and ***market value–based*** risk measures.
- For high-yield portfolio managers: credit risk is usually the most important consideration.
- **Credit risk**:
  - **Default risk**: The probability that a borrower defaults or fails to meet its obligation to make full and timely payments of principal and interest.
  - **Loss given default (loss severity)**: is the amount of loss if a default occurs.
  - **Credit loss rate= default rate×the loss severity**

Credit migration risk and spread risk

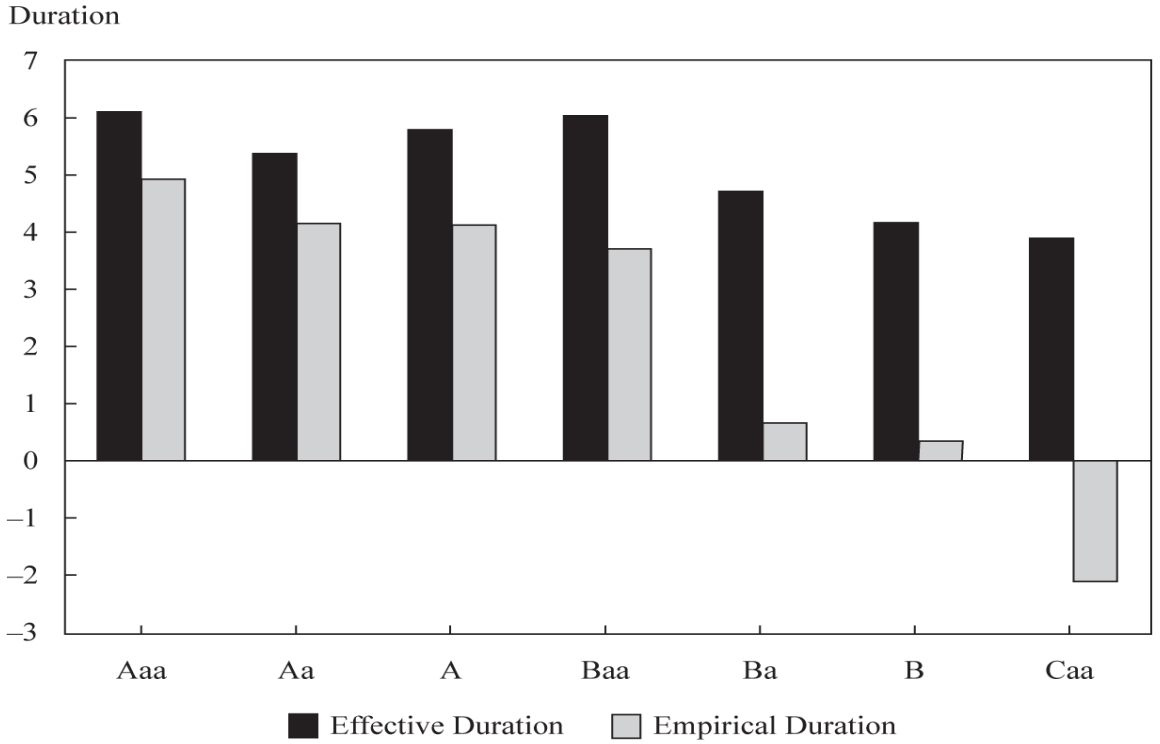
- For **investment-grade** portfolio managers: ***credit migration risk***, ***spread risk***, and in particular, ***interest rate risk*** are typically the most relevant considerations.
- **Credit migration risk**
  - The forced sales caused by the credit quality decreasing of investment-grade bonds can result in losses to a portfolio.
- **Spread risk**: the spread risk in an investment-grade portfolio consisting of floating-rate bonds should be measured by spread duration.
  - **Spread duration**
    - ✓ Spread duration measures an option-free bond's price change if only spread (due to credit risk) has changed.
    - ✓ Δspread=1% → Δ price

Interest rate risk

- **Interest rate risk**
  - A bond's yield = a default risk-free interest rate + a spread
  - **In theory**, a change in interest rates has the ***same effect*** on a risk-free bond (a bond assumed to have no default risk) as it does on a risky bond.
  - **In practice**, however, ***credit spreads tend to be negatively correlated with risk-free interest rates***.
    - ✓ changes in risk-free rates tend to generate smaller changes in corporate bond yields than theoretical measures of duration suggest.
    - ✓ Bonds with large credit spreads have less sensitivity to interest rate changes than bonds with smaller credit spreads.
  - **Empirical duration**: is a measure of interest rate sensitivity that is determined from market data.

Interest rate risk

➢ Effective Duration and Empirical Duration by Rating Category



- **Highly rated bonds**, which typically have lower credit spreads, have greater empirical duration.
- **Caa rated bonds** actually have negative empirical durations.

Example

- For example, Westpac also has a floater maturing on 13 May 2021. This bond also has a spread duration of 4.70 years, but its modified duration is only 0.21. The floater trades at a price of 100.55 with a credit spread of 88 bps. If its credit spread narrows by 20 bps, and interest rates are unchanged. **Calculate the price of this bond after credit spread changes.**
- **Correct Answer:**
  - $100.55 \times (-4.70 \times -0.0020) + 100.55 = 101.50$

Liquidity risk

- **Liquidity**
  - **Effective factor**
    - ✓ bond's issue size ↑; the size of the market ↑; Bonds that are held in dealers' inventories ↑; → Liquidity ↑
  - **Implications**
    - ✓ High-yield bond portfolios is **more costly**;
    - ✓ **Investment-grade bonds** are usually quoted as spreads over benchmark government bonds;
    - ✓ **High-yield bonds** are usually quoted in price terms.

2. Credit spread

- **Credit spread:** is perhaps the single most important measure in credit security selection.
- **Benchmark Spread = the yield on a credit security - the yield on a benchmark bond with a similar duration**
  - Usage: pricing and hedging credit securities;
  - Disadvantages: the potential maturity mismatch.

Credit spread

- **G-Spread = the yield on a credit security - the yield on government bond (When interpolated, weighted by duration.)**
  - **Advantage**: simplicity. It is easy to calculate and understand, and different investors usually calculate it the same way.
  - **Usage**:
    - ✓ Is useful for portfolio construction, because the calculation indicates a way to hedge the credit securities' interest rate risk.
    - ✓ Is also useful for estimating yield and price changes for fixed-rate credit securities without embedded options.

Example

- On 31 March 2016, a portfolio manager gathers information for the following bonds.
  1. Citigroup 3.75% due 16 March 2024
  2. US Treasury 1.5% due 31 March 2023 (on-the-run 7-year Treasury note)
  3. US Treasury 1.625% due 15 February 2026 (on-the-run 10-year Treasury note)

	Price	Yield	Maturity	Effective Duration
Citigroup 3.75%	103.64	3.24%	7.96	7.0
US Treasury 1.5%	99.80	1.53%	7.00	6.7
US Treasury 1.625%	98.70	1.77%	9.88	9.1

Later, the 7-year Treasury note's yield falls from 1.53% to 1.43% while the 10-year Treasury note yield remains unchanged.

Example

- **Q1: What is the new yield on the Citigroup, assuming its spread remains unchanged ?**
- **Correct Answer :**
  - Assume weight of the 7-year note "a", weight of the 10-year note "b".
  - Maturity match: 7.0 a + 9.88b = 7.96; a + b = 1 → a= 66.7%; b=33.3%.
  - The linearly interpolated yield on the 7.96-year benchmark maturity is: 66.7%×1.53% + 33.3%×1.77% = **1.61%**.
  - The G-spread on the Citigroup bond is 1.63% = 3.24% – 1.61%.
  - The new yield on the interpolated Treasury: **1.54%** = [66.7%(1.43%) + 33.3%(1.77%)].
  - The interpolated Treasury yield has fallen by 0.07%, from 1.61% to 1.54%.
  - Add the G-spread of 1.63% to the interpolated Treasury yield to arrive at a new yield for the Citigroup bond：3.17%=1.54%+1.63%.

Example

- **Q2: Based on the interest rate changes, what is the new price of the Citigroup bond ?**
- **Correct Answer :**
  - The new price on the Citigroup bond can be estimated based on its yield change and its duration. The price has risen from 103.64 to 104.15:

$$104.15 = 103.64 \times [1 + (7 \times 0.07\%)]$$

  - Representing an absolute increase of 0.51 or a percentage increase of 0.49%.

Credit spread

- **I-Spread = the yield on a credit security - the swap rates denominated in the same currency**
  - **Advantage**: swap curves may be “smoother” (less disjointed) than government bond yield curves.
    - ✓ Government bond yield curves are sometimes affected by supply and demand for specific government bonds, especially on-the-run issues.
- **Two points in evaluating G-spread and the I-spread**
  - Yields on government bonds or interbank rates may not provide a good representation of risk free rate, when the market perceives credit risk in either a country’s government bonds or its banks;
  - When using benchmark bonds to hedging interest rate exposure, the choice of hedging instrument should correspond to the choice of spread measure used.

Credit spread

- **Z-spread**

$$P = \frac{PMT_1}{(1 + r_{s1} + Z - spread)^1} + \frac{PMT_2}{(1 + r_{s2} + Z - spread)^2} + \cdots + \frac{PMT_n}{(1 + r_{sn} + Z - spread)^n} + \frac{PRN}{(1 + r_{sn} + Z - spread)^n}$$

  - **Usage**: compare relative value for bonds without embedded options.
- **Option-adjusted spread**
  - Is the constant spread that, when added to all the one-period forward rates on the interest rate tree, makes the arbitrage-free value of the bond equal to its market price.
  - **Usage**: is ***most useful for comparing bonds with different features***, such as ***embedded options***.
  - **Disadvantages**
    - ✓ Depends on the assumptions of future interest rate volatility.
    - ✓ The realized spread will either be more or less than the OAS, depending on whether the option is actually exercised.
  - The ***most appropriate*** measure for a **portfolio-level spread** is the ***OAS***. To calculate a portfolio OAS, **each bonds OAS is weighted by its market value**.

Expected excess return

- **Holding-period excess return**
  - XR ≈ ($s \times t$) – ($\Delta s \times$ SD)
  - Where XR is the holding-period excess return, s is the spread at the beginning of the holding period, t is the holding period expressed in fractions of a year, Δs is the change in the credit spread during the holding period, and SD = spread duration.
- **Expected excess return**
  - EXR ≈ ($s \times t$) – ($\Delta s \times$ SD) – ($t \times p \times L$)
  - Where p is the annualized expected probability of default , L is the expected loss severity.
  - Note that the term ($p \times L$) is the *expected annual credit loss*.

Example

- A corporate bond has a spread duration of five years and a credit spread of 2.75%.
  1. What is the approximate excess return if the bond is held for six months and the credit spread narrows to 2.25%? Assume the spread duration remains at five years and that the bond does not experience default losses.
  2. What is the instantaneous (holding period of zero) excess return if the spread rises to 3.25%?
  3. Assume the bond has a 1% annualized expected probability of default and expected loss severity of 60% in the event of default. What is the expected excess return if the bond is held for six months and the credit spread is expected to fall to 2.25%?

Example

- **Correct Answer:**
  - **Solution to 1:**

    Using Equation 1, the excess return on the bond is approximately 3.875% = (2.75% × 0.5) – [(2.25% – 2.75%) × 5].
  - **Solution to 2:**

    Using Equation 1, the instantaneous excess return on the bond is approximately −2.5% = (2.75% × 0) – [(3.25% – 2.75%) × 5].
  - **Solution to 3:**

    Using Equation 2, the expected excess return on the bond is approximately 3.575% = (2.75% × 0.5) – [(2.25% – 2.75%) × 5] – (0.5 × 1% × 60%).

3. Credit strategy approaches

- **Bottom-up approach (overview)**
  - It may be easier to gain an information advantage with bottom-up because the manager can focus on only the least efficient sectors of the market to identify individual over- or undervalued securities.
  - Bottom-up analysis works best when comparing bonds with fairly homogeneous credit risk exposure; such as within Investment-grade bonds or High-yield bonds.
  - The problem is macro factors such as portfolio duration and interest rate change can overwhelm value added with individual security valuation changes.

3. Credit strategy approaches

- **Top-down approach (overview)**
  - Top down has an advantage in that it focuses directly on those macro factors that drive interest rates, average credit spreads, and default losses.
  - The problem is these same factors are examined by many others and it may be harder to gain an information advantage.

Bottom-up approach

- **Bottom-up approach** involves selecting the individual bonds or issuers that the investor views as having ***the best relative value*** from among a set of bonds or issuers with similar features.
  - **Divide the Credit Universe.**
    - ✓ Establishing her universe of eligible bonds and then dividing the universe of eligible bonds into industry sectors
  - **Identify the "best" relative value bond within each sector.**
    - ✓ The key to relative value decisions is weighing the compensation for credit-related risks (that is, ***the expected excess return***) against the expected magnitude of the credit-related risks.
      - ◆Historical default rate
      - ◆Information on the average spread level for each sector and credit rating

Bottom-up approach

- **Identify the "best" relative value bond within each sector.**
  - **Spread curve**: A spread curve is the fitted curve of credit spreads for each bond of an issuer plotted against either the maturity or duration of each of those bonds.
    - ✓ A few bonds above or below the fitted spread curves should be investigated further before taking action, such as: issued by different subsidiaries, have different levels of seniority, risk or liquidity.
    - ✓ **outperform a benchmark**: maintain an overweight position on best relative value bond.
    - ✓ **generate positive absolute returns**: express relatively negative view on other bonds by purchasing default protection through credit default swaps (CDS), by buying put options, or by shorting underperformed bonds.

Bottom-up approach

- **Identify the "best" relative value bond within each sector.**
  - **Bond structure.** In performing relative value analysis, an investor must be careful to consider the features of the bonds and their priority in the capital structure.
  - **Issuance date.** Bonds that have been recently issued by entities with frequent bond issues tend to have narrower bid–offer spreads and greater daily transaction volume.
  - **Supply.** When an issuer announces a new corporate bond issue, the issuer's existing bonds often decline in value, and their spreads widen.
  - **Issue size.** Issue size and its effects on credit valuation can vary.

Example

- At the end of 2016, an analyst is about to conduct a relative value analysis of **the following bonds issued by a single company**. All of these bonds are available in the market at the time he is conducting his analysis:

	Coupon (%)	Maturity	Credit Rate	Issue Size (billion)	D	P	Yield (%)	Credit Spread (bps)
A	2.40	12/31/18	A2/A	2	2.0	100	2.40	40
B	3.50	12/31/21	A2/A	1.5	4.6	100	3.50	50
C	8.00	9/30/22	Ba1/BB+	0.05	4.7	109.5	6.02	299
D	5.00	12/31/46	A2/A	1	15.8	100	5.00	100

- Evaluate whether the analyst should include Bond C in the relative value analysis.

Example

- **Correct Answer:**
  - Bond C has a much higher spread than the company's other bonds. The analyst should try to identify the cause(s) of this difference before including Bond C in the relative value analysis.
    - ✓ Bond C's higher coupon and **lower credit rating** suggest that it is riskier than the other bonds.
    - ✓ Bond C may be **subordinated** in the company's capital structure.
    - ✓ Bond C also has a much **smaller issue size**, indicating that the bond may be less liquid than the company's other bonds. Relatively illiquid bonds often carry greater spreads to compensate investors for this disadvantage.
    - ✓ Finally, Bond C's higher price means that **the loss in the event of default** is likely to be larger.
    - ✓ To summarize, it is most likely unsuitable to include Bond C in the relative value analysis.

Example

- The company is issuing a new 10-year bond with the following features:

Bond	Coupon	Maturity	Tenor	Credit Rate
E	4.00%	12/31/2026	10	A2/A

Issue Size	Duration	Price	Yield	Credit Spread (bps)
3,000,000,000	8.2	100	4.00%	80

  - Explain how the analyst may compare the relative value of the company's new issue with that of the outstanding bonds.

Example

- **Correct Answer:**
  - The company has no outstanding bonds maturing around 2026. The spread for a bond maturing in 2026 can be roughly interpolated, however, using issues already in the market.
  - The spread should be somewhere between the spreads of Bonds B and D.
  - Using the bonds' durations to interpolate, we find the interpolated spread to be $50 + \{[(8.2 - 4.6)/ (15.8 - 4.6)] \times (100 - 50)\} = 66$.
  - The new issue, with a spread of 80 bps, appears to be attractively valued in the context of the company's outstanding issues.

Bottom-up portfolio construction

- **Portfolio Construction:** identify a model portfolio with ideal position sizes according to both sector and individual bonds. Then buy the bonds that most closely represent the appropriate risk exposures in the model portfolio.
  - **Divided the universe into sectors**
  - **Weightings of these sector**
    - ✓ **Market value**: default losses are a significant concern
    - ✓ **Spread duration**: defaults are unlikely and spread change is the more relevant risk
    - ✓ Spread duration is more commonly used for investment grade, and market value is more commonly used for high yield.

Bottom-up portfolio construction

- When obtaining desired bonds are challenging, investors typically use several alternatives to deal with
  - **Substitution**: the second (or third, and so on) most attractively valued security in a sector may be a reasonable substitute for an investor's most preferred bond;
  - **Indexing**: constructing a portfolio to mirror the performance of a specified index is called indexing;
  - **Cash**: if the investor expects that his desired bonds will soon be available, then holding cash as a substitute may be a useful option.

Top-down approach

- **Top-down approach**
  - ***Choose sectors*** of the credit market with attractive relative value ***based on macro factors***.
    - ✓ Sector divisions used by a top-down investor are often broader.
  - Selecting the bonds from these sectors.
  - Overweight those sectors by purchasing bonds in those sectors.

Top-down approach

- **1. Macro factors that are important**
  - economic growth; overall corporate profitability; default rates; risk appetite; changes in expected market volatility; changes in credit spreads; interest rates; industry trends; and currency movements.
- **2. Desired credit quality determination**
  - **Credit cycle**: Expectations for the credit cycle are reflected in variations of the default rate over time;
  - **Credit spread changes**: Changes in credit spreads are usually **a good predictor** of changes in **default rates** one year ahead. An investor seeking to outperform the market will likely need a forecast horizon longer than one year.

Top-down approach

- **3. Assess the credit quality**
  - **Average credit rating:** Arithmetic weighting and Non-arithmetic weightings

Moody's	S&P	Fitch	Arithmetic Factor	Moody's Rating Factor
Aaa	AAA	AAA	1	1
Aa3	AA–	AA–	4	40
A1	A+	A+	5	70
Baa1	BBB+	BBB+	8	260
Baa2	BBB	BBB	9	360
Baa3	BBB–	BBB–	10	610
Ba1	BB+	BB+	11	940
Ba2	BB	BB	12	1,350
Ba3	BB–	BB–	13	1,766
B1	B+	B+	14	2,220
B2	B	B	15	2,720

Example

- A portfolio in which 50% of the bonds are rated A1/A+ and the other 50% are rated Ba3/BB−.
- **Using arithmetic weighting:**
  - The average credit quality score is (50% × 5) + (50% × 13) = 9. This score of 9 corresponds to an average credit rating of **Baa2/BBB**.
- **Using a non-arithmetic weighting:**
  - The average credit quality score is 918 = (50% × 70) + (50% × 1,766). The score of 918 corresponds most closely to an average credit rating of **Ba1/BB+**.
- The average credit rating using non-arithmetic weightings is two levels (notches) below the rating using arithmetic weighting.
- When portfolio span a broad range of the credit spectrum, ***arithmetic weighting will underestimate its credit risk***.

Top-down approach

- **3. Assess the credit quality (cont.)**
  - **Average OAS**
    - ✓ Credit quality without the risk of credit spread volatility;
    - ✓ To calculate a portfolio's average OAS, each bond's individual OAS is weighted by its market value.
  - **Average spread duration**
    - ✓ The risk of credit spread volatility.
  - **Duration times spread (DTS)**
    - ✓ A measure of credit quality that attempts to account for both average OAS and average spread duration;
    - ✓ **DTS= spread duration×OAS**
    - ✓ Less intuitive than average spread duration and average OAS.

Top-down approach

- **4. Industry sector allocation**
  - **Quantitative tools**: such as regression analysis
    - ✓ For example, the average spread of bonds within an individual industry sector and rating category could be compared with the average spread of the bonds that are in that same rating category but exclude the chosen industry sector.
  - **Information** on spreads in an industry sector and other considerations
    - ✓ For example, the portfolio manager may consider that the credit quality of BB rated bonds in the media industry sector is superior to the credit quality of the average BB rated bond.
  - **Financial ratio analysis**
    - ✓ Compare sectors on a spread-versus-leverage basis to identify relative value opportunities.
- **5. Expected excess return in top-down approach**
  - EXR $\approx (s \times t) - (\Delta s \times \text{SD}) - (t \times p \times L)$

Top-down approach

- **1. Interest rate measurement and management**
  - Actively manage the portfolio based on expectations of future changes in interest rates and future interest rate volatility.
- **Measure interest rate exposure**
  - **Effective duration**: **parallel** yield curve shifts.
    - ✓ Expects yields will **decline** by more than what the market is pricing: make its effective duration is **greater** than the benchmark duration.
  - **Key rate duration**: **non-parallel** yield curve shifts.
    - ✓ Expects yield curve will flatten beyond what is priced into market: structure portfolio to be more sensitive to long-term interest rates and less sensitive to short-term interest rates.
  - **Effective convexity**: the exposure to **interest rate volatility**.
    - ✓ Expects interest rate volatility will be high: structure the portfolio to have greater convexity than the benchmark.

Top-down approach

- **Manage interest rate exposure (cont.)**
  - **Derivatives**
    - ✓ Manage the portfolio's effective duration and key rate durations
    - ✓ **Advantages**
      - ◆Key rate durations can be controlled independently of credit spread curve exposures;
      - ◆High liquidity.
    - ✓ **Disadvantages**
      - ◆Not all investors are willing or able to use derivatives.

Top-down approach

- **Manage interest rate exposure**
  - **Maturity management**
    - ✓ select appropriate credit securities to target effective duration and key rate durations
    - ✓ **Advantages**
      - ◆It can be accomplished without the use of derivatives.
    - ✓ **Disadvantages**
      - ◆It may be difficult to match key rate durations closely, for desired corporate bonds are not available in all maturities.
      - ◆Duration and yield curve exposure will change in the same direction.
      - ◆Without using derivatives, it is almost impossible to structure an absolute return portfolio with low or zero interest rate exposure, unless the portfolio consists exclusively of bonds with very short maturities or floating-rate notes.

Top-down approach

- **2. Interest rate volatility management**
  - Credit securities: callable bonds or agency pass-through mortgages.
  - Derivatives: options.
- **3. Country and currency exposure**
  - Portfolio will be exposed to currency fluctuations as well as changes in interest rates;
  - It is more common for investors to use forwards and futures to manage currency exposures;
  - These instruments are generally highly liquid and enable investors to manage currency risk separately from other portfolio exposures.
- **4. Spread curves**
  - A particular credit spread curve will flatten or steepen, and two spread curves will converge or diverge.

Example: Top-down analysis

- An investor with a 1-year holding period is analyzing 4 single rating indexes. Each index uses bonds that all have the same credit rating.

Index Rating (numeric value)	Current OAS, bp	Projected OAS, bp	Projected Credit Loss %, (p x L)*	Spread Duration
A(1)	275	250	0.01	4.5
BBB(2)	325	285	0.04	5.5
BB(3)	475	400	0.12	4.3
B(4)	625	499	0.37	5.8

* p = annualized expected probability of default
L = expected loss severity

- The numeric value in parentheses after the letter rating is used by the investor to determine arithmetic weighted average portfolio credit value.

Example: Top-down analysis

1. **Calculate** the expected annual excess return for a portfolio weighted 50/50 in Index BBB and BB.
2. **Calculate** average current OAS, spread duration, and duration times spread (DTS) for the portfolio in Question 1.
3. **Calculate** the average numeric credit rating for the portfolio in Question 1 as well as a portfolio weighted 50/50 in Index A and B.
4. **Discuss** the ways in which comparing the two average portfolio credit ratings in Question 3 to determine the portfolios exposure to credit risk is misleading and state three alternate ways to measure the credit risk exposure using the information provided. No calculations are required.

Example: Top-down analysis

- **Answers:**

1. Average portfolio starting OAS: 0.5(325) + 0.5(475) = 400 bps
   Average portfolio spread change: 0.5(285 – 325) + 0.5(40O – 475) = 58 bps decline
   Average portfolio credit losses: 0.5(4) + 0.5(12) = 8 bps loss
   Average portfolio spread D: 0.5(5.5) + 0.5(4.3) = 4.90
   Expected excess return: 1(400) + 4.9(58) – 8 = 676 bps

2. Average portfolio starting OAS: 0.5(325) + 0.5(475) = 400 bps
   Average portfolio spread D: 0.5(5.5) + 0.5(4.3) = 4.90
   Average portfolio duration times OAS: 4.9 (400) = 1960 bps

Example: Top-down analysis

3. Portfolio BBB and BB: 0.5(2) + 0.5(3) = 2.5
   Portfolio A and B: 0.5(1) + 0.5(4) = 2.5

4. Credit risk typically increases at a more than linear rate as credit rating quality is lowered. That means portfolio A and B is likely risker than BBB and BB even though the average numbers are the same. Other ways to compare credit risk exposure are to compare:
   - Average OAS.
   - Average spread Duration.
   - Average Duration times spread (DTS).

Bottom-up and top-down approaches

- **In practice, investors often combine top-down and bottom-up approaches.**

	Bottom-up approaches	Top-down approaches
Advantages	It is easier to gain an informational advantage in individual companies or bonds.	A sizable portion of credit returns can be attributed to macro factors.
Disadvantages	It can be difficult to earn substantial returns from bottom-up security selection without exposing to macro factors, using leverage or taking short positions.	It can be difficult for an investor to gain an informational advantage in a top-down approach.

Bottom-Up and Top-Down Approaches

- A credit investor has conducted extensive research on the European chemicals and consumer staples industries. He is constructing a portfolio of bonds issued by companies in these industries. The investor seeks to outperform a benchmark consisting of bonds issued by European chemicals and consumer staples companies.
  Evaluate whether a top-down or bottom-up approach is most appropriate for this investor.

- **Correct Answer:**
  - A bottom-up approach is more appropriate for this investor.
  - The key aspect of the bottom-up approach to credit strategy is assessing the relative value of individual bonds or issuers.
  - The investor has conducted extensive research on companies within the industries. And his benchmark is consisting of bonds issued by European chemicals and consumer staples companies.

4. Liquidity risk

- **Liquidity risk**
  - **Effective factor**
    - ✓ Bond's issue size; the size of the market; Bonds that are held in dealers' inventories;
    - ✓ The growth of electronic trading platforms (ETPs) has potentially improved credit market liquidity.

Liquidity risk

- **Measure of secondary market liquidity risk**
  - **US data are used** to evaluate liquidity. Because data may be less available in other markets.
  - **Trading volume**
  - **Spread sensitivity to fund outflows**
    - ✓ is affected by economic conditions;
    - ✓ can be measured as spread widening;
    - ✓ For a given percentage outflow, there is a greater effect on high-yield prices and spreads than on investment-grade.
  - **Bid–ask spreads**
    - ✓ Bid-ask spread is stable only when market are stable;
    - ✓ Volatile market conditions often have a negative effect on bid–ask spreads.

Liquidity risk

- **Structural industry changes and liquidity risk**
  - Structural changes following the 2008–2009 global financial crisis
    - ✓ New regulations restricted dealers' ability to take risk, hold inventories, and engage in some trading activities.
    - ✓ Dealers generally became more risk averse and opted to reduce risk and balance sheet size.
  - Effects in liquidity risk
    - ✓ Dealers decrease bond positions on balance sheets → decrease liquidity
    - ✓ Dealers reduced bond positions concentration → increases liquidity

Liquidity risk

- **Management of liquidity risk**
  - **Holding cash**
  - **Managing position sizes**: more-liquid credit securities are given greater portfolio weight, all else being equal.
  - **Holding liquid, non-benchmark bonds**
    - ✓ outside portfolio managers' benchmark.
  - **Credit default swap (CDS) index** derivatives
  - **Exchange-traded funds (ETFs)**
    - ✓ Disadvantage: because ETFs are easy to trade, the funds may experience unusual market movements during periods of high credit volatility, and their prices may deviate from their net asset values.

Tail risk

- **Tail risk:** is the risk that there are more actual events in the tail of a probability distribution than probability models would predict.
- **Assess tail risk**
  - **Scenario analysis**
    - ✓ Examines portfolio performance under specific situations.
  - **Historical scenario analysis**
    - ✓ Past periods when securities prices demonstrated unusual behavior.
  - **Hypothetical scenario analysis**
    - ✓ Envisioning events that have not occurred but might cause large moves in security prices.
  - **Correlations in scenario analysis**
    - ✓ Assessing potential changes in correlations between security prices.
    - ✓ Because many portfolios depend on diversification as a source of risk management. During periods of financial crisis, correlations tend to move closer to 1.0.

Tail risk

- **Manage tail risk**
  - **Portfolio diversification**
    - ✓ **Advantages**: this strategy may have only a modest incremental cost.
    - ✓ **Limitations**
      - ◆It is difficult to identify attractively valued investment opportunities;
      - ◆Portfolio diversification may not fully achieve an investor's objectives.
  - **Tail risk hedge**: using securities or derivatives (CDS and options)
    - ✓ **Disadvantages**
      - ◆It has a cost, and tail risk hedges tend to be most expensive when the tail risk event seems most likely to occur;
      - ◆Investors who cannot use derivatives may be unable to hedge certain tail risks.

5. International credit markets

- **Investment opportunities**
  - There will be relative value opportunities when country or regional differences arise in
    - ✓ **Credit cycle**
      - ◆Determining the timing and location of credit cycle weakening.
    - ✓ **Credit quality of issuer** (when market change extremely)
    - ✓ **Sector composition** (when market change extremely)
    - ✓ **Market factor**
      - ◆Supply factors and demand factors may differ as a result of location and investor preferences, will cause the significant valuation differences.

International credit markets

- **Risk consideration**
  - **Emerging markets credit (risk)**
    - ✓ **Concentration in *commodities and banking*.**
    - ✓ **Government ownership**
      - ◆Advantage: government will provide explicit or implicit support in the event of a perilous financial situation for the company;
      - ◆Disadvantage: the uncertainty in the contractual rights and interests of non-domestic bondholders as part of a debt restructuring.
    - ✓ **Credit quality**
      - ◆Rating agencies typically apply a "***sovereign ceiling***" to corporate issuers globally, so the emerging market credit universe has a ***high concentration in both the lower portion of the investment-grade rating spectrum and the upper portion of high yield***.

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International credit markets

- **Risk consideration**
  - **Global liquidity (risk)**
    - ✓ All credit markets tend to have liquidity issues, but the level of illiquidity varies across countries and regions.
  - **Currency risk**
    - ✓ Can use currency swaps to hedge foreign exchange exposures.
  - **Legal risk**
    - ✓ Global differences in regulations and laws, such as bankruptcy laws.

6. Structured financial instruments

- Common types of structured financial instruments include: mortgage-backed securities (**MBS**), asset-backed securities (**ABS**), collateralized debt obligations (**CDOs**), and **covered bonds**.
  - **Advantages**
    - ✓ Higher portfolio returns;
    - ✓ Relative value opportunities may exist because corporate credit securities and structured financial instruments often differ in their features, valuation, and risk exposures;
    - ✓ Can make exposure to a specific market or macroeconomic factor;
    - ✓ Improve portfolio diversification.

Mortgage-Backed Securities

- **MBS:** are a form of ABS that represent rights to receive cash flows from portfolios of mortgage loans.
  - **Advantages**
    - ✓ **High Liquidity**
    - ✓ **Less default risk**
    - ✓ **Exposure to real estate**
      - ◆MBS can be used more directly express targeted or levered investment views on the real estate sector.
    - ✓ **Exposure to expected changes in interest rate volatility**
      - ◆Interest rate decreases, MBS will suffer prepayment risk; interest rate *increases,* MBS will suffer extension risk.
      - ◆So if an investor expects that interest rate volatility will decrease, she can buy agency MBS in her portfolio.

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Asset-Backed Securities

- **ABS:** is backed by several types of non-mortgage assets as collateral, including automobile loans, automobile lease receivables, credit card receivables, student loans, bank loans, and accounts receivable.
  - **Advantages**
    - ✓ Are more-liquid alternatives to corporate bonds for expressing views on some sectors;
    - ✓ Can express views on consumer credit;
    - ✓ Can provide portfolio diversification and return benefits.

Collateralized Debt Obligations(CDOs)

- **Collateralized debt obligation:** is a security backed by a diversified pool of one or more debt obligations.
- **Exposure to Default Correlations:**
  - As ***correlations increase***, the ***value of equity*** tranches usually ***increases*** relative to the value of senior and mezzanine tranches.
  - Correlation tend to be ***highly negative***, can profit by ***selling the subordinated***, and ***buying the senior tranche***.
  - Correlation tend to be ***highly positive***, can profit by ***buying the subordinated***, and ***selling the senior tranche***.

Collateralized Debt Obligations(CDOs)

- **Advantages**
  - **Relative value:** the valuation of CDOs may vary from the valuation of their underlying collateral.
  - **Leveraged Exposure to Credit:**
    - ✓ Mezzanine and equity tranches can gain additional return, if the underlying collateral has strong returns.
- **Disadvantages**
  - Do not provide much diversification;
  - Do not offer unique exposure to a sector or market factor.

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Covered Bonds

- **Covered bond**: is a debt obligation issued by a financial institution, usually a bank, and backed by a segregated pool of assets called a “cover pool”.
  - **Advantage**
    - ✓ In the event of default, bondholders have recourse against ***both the financial institution and the assets*** in the cover pool.

It’s not the end but just beginning.

Your life can be enhanced, and your happiness enriched, when you choose to change your perspective. Don't leave your future to chance, or wait for things to get better mysteriously on their own. You must go in the direction of your hopes and aspirations. Begin to build your confidence, and work through problems rather than avoid them. Remember that power is not necessarily control over situations, but the ability to deal with whatever comes your way.

一旦变换看问题的角度，你的生活会豁然开朗，幸福快乐会接踵而来。别交出掌握命运的主动权，也别指望局面会不可思议的好转。你必须与内心希望与热情步调一致。建立自信，敢于与困难短兵相接，而非绕道而行。记住，力量不是驾驭局势的法宝，无坚不摧的能力才是最重要的。

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