Trading, Performance Evaluation, and Manager Selection

CFA三级培训项目

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Topic in CFA Level III

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Framework

Trading, Performance Evaluation, and Manager Selection

- **SS13: Trading, Performance Evaluation, and Manager Selection**
  - R25 Trade Strategy and Execution
  - R26 Portfolio Performance Evaluation
  - R27 Investment Manager Selection

Trade Strategy and Execution

Framework

1. Motivations to Trade
2. Trading Strategies and Strategy Selection
   - Trade Strategy Inputs
   - Reference Prices
   - Trade Strategies
3. Trade Execution (Strategy Implementation)
   - Trade Implementation Choices
   - Algorithmic Trading
   - Comparison of Markets
4. Implementation Shortfall
5. Evaluating Trade Execution
6. Trade Governance

Motivations to Trade

- Portfolio managers need to trade their portfolio holdings to ensure **alignment** with the fund's underlying **investment strategy and objectives**.
  - Profit seeking
  - Risk management/hedging needs
  - Cash flow needs
  - Corporate actions/index reconstitutions/margin calls

Motivations to Trade

- **Profit seeking**
  - The primary added value that most active managers seek to provide is risk-adjusted outperformance relative to their benchmark.
  - **Trade urgency & alpha decay**
    - ✓ **Trade urgency** refers to how quickly (aggressively) or slowly (patiently) the order is executed over the trading time horizon.
    - ✓ **Alpha decay** refers to the erosion or deterioration in short-term alpha once an investment decision is made.
      - ◆ Managers following **a short-term alpha-driven strategy** will trade with **greater urgency** to realize alpha before it dissipates (decays).
        - ☐ Michigan Index of Consumer Sentiment (short-term profit seeking)
      - ◆ Managers following **a longer-term strategy** will trade with **less urgency** if alpha decay is expected to be slower.
        - ☐ Value manager (long-term profit seeking)

Motivations to Trade

- **Risk management/hedging needs**
  - As the market and the risk environment change, portfolios need to be traded or rebalanced to **remain at targeted risk levels or risk exposures**.
    - ✓ Duration match,
    - ✓ Beta management.
  - Portfolio managers may also trade to **hedge risks** when they **do NOT have an investment view** on the specific risk in question.
    - ✓ Currency hedging, CDSs, option strategies.

Motivations to Trade

- **Cash flow needs**
  - This type of trading is often **client driven**, arising from fund inflows (orders, mandates) and outflows (redemptions, liquidations).
  - Cash flow needs may involve high or low trade urgency
    - ✓ **high trade urgency**: collateral/margin calls
    - ✓ **low trade urgency**: longer-term client asset allocation changes
  - To minimize **cash drag** on a portfolio, fund inflows may be **equitized** using futures or ETFs until the next portfolio rebalance or positions in the underlying can be traded.
    - ✓ **Equitization** refers to a strategy of temporarily investing cash using futures or ETFs to gain the desired equity exposure before investing in the underlying securities longer term.
    - ✓ Equitization may be required if large inflows into a portfolio are hindered by lack of liquidity in the underlying securities.

Motivations to Trade

- **Corporate actions/index reconstitutions/margin calls**
- Trading may be liquidity driven resulting from client activity or index reconstitutions.
  - Trading may also be necessitated by such activity as corporate actions and operational needs.
    - ✓ Dividend/coupon reinvestment, distributions, margin calls, and expiration of derivative contracts
  - For index tracking portfolios, such index changes as additions, deletions, and constituent weight changes are generally traded in the manager's portfolio to reflect benchmark exposure.
  - Margin or collateral calls may drive high levels of trade urgency, given a need for the immediate sale of portfolio holdings.
- In these cases, managers typically trade using end-of-day closing prices because these prices are used for fund and benchmark valuation.

Trading Strategies and Strategy Selection

- **Trade Strategy Inputs**
  - Order Characteristics
  - Security Characteristics
  - Market Conditions
  - User-Based Considerations: Trading Cost Risk Aversion
  - Market Impact and Execution Risk
- **Reference Prices**
  - Pre-Trade Benchmarks
  - Intraday Benchmarks
  - Post-Trade Benchmarks
  - Price Target Benchmarks
- **Trade Strategies**
  - Short-Term Alpha Trade
  - Long-Term Alpha Trade
  - Risk Rebalance Trade
  - Client Redemption Trade
  - New Mandate Trade

Trade Strategy Inputs

- **Order Characteristics**
  - **Side**: the side or trade direction of the order—for example, buy or sell.
    - ✓ If prices are rising, executing a buy order may take longer than executing a sell order, given the presence of more buyers (liquidity demanders) than sellers (liquidity suppliers) in the market.
    - ✓ Trading a list that consists of only buys or only sells will have greater market risk exposure than a list of buys and sells in which the securities have offsetting market risk exposures.
  - **Size**: the total amount or quantity of the security being transacted.
  - **Relative size (% of ADV):** order size as a percentage of the security's average daily volume (ADV).

Trade Strategy Inputs

- **Market Conditions**
  - **Liquidity crises**: deviations from expected liquidity patterns due to periods of crisis.
    - ✓ During market events or crises, the **volatility** and **liquidity** of the market and the security will be critical to consider as conditions result in sudden and significant deviations from normal trade patterns.
    - ✓ During normal market environment, some companies will reach market value, which may result in them being added or removed from the widely used stock index. When this happens, liquidity in their stocks tends to improve or deteriorate as their stocks become broader or narrower.
  - Market volatility and liquidity are **dynamic**. They are also generally **negatively related**, which becomes apparent especially during periods of crisis, when volatility increases and liquidity decreases.

Trade Strategy Inputs

- **Market Impact and Execution Risk**
  - **Market impact** is the adverse price impact in a security caused from trading an order and can represent one of the largest costs in trading.
    - ✓ To minimize information leakage, portfolio managers may attempt to hide their trading activity by executing orders across different venues and using a mix of order types, such as market and limit orders.
  - **Execution risk** is the adverse price impact resulting from a change in the fundamental value of the security and is often proxied by price volatility.
- **Trader's dilemma.** Trading too fast results in too much market impact, but trading too slow results in too much market risk.
- **The goal in selecting a trading strategy** is to choose the best **price–time trade-off** given current market conditions and the unique characteristics of the order.

Trade Strategy Inputs

- **Security Characteristics**
  - **Security type**: the type of security being traded (underlying, ETF, American depositary receipt, global depositary receipt).
  - **Short-term alpha**: (trading alpha or trade alpha) may arise from an appreciation, a depreciation, or a reversion (i.e., reversal) in security price.
    - ✓ High rates of alpha decay, or alpha loss, require faster, or more accelerated, trading to realize alpha before it is traded on by other market participants.
  - **Price volatility**: the annualized price volatility of the security. The price volatility of a security primarily affects the execution risk of the trade.
    - ✓ **Execution risk** is the risk of an adverse price movement occurring over the trading horizon owing to a change in the fundamental value of the security or because of trading-induced volatility.
    - ✓ Securities with higher levels of price volatility have greater exposure to execution risk than securities with lower price volatility.
  - **Security liquidity**: the liquidity profile of the security (e.g., ADV, bid–ask spread, average trade size).
    - ✓ All else being equal, greater liquidity reduces execution risk and trading costs, such as market impact.

Trade Strategy Inputs

- **User-Based Considerations: Trading Cost Risk Aversion**
  - A portfolio manager or trader with **a high level of risk aversion** is likely to be
    - ✓ more concerned about **market risk**
    - ✓ tend to trade with greater trade **urgency** to avoid the greater market exposure associated with trading more patiently.

Reference Prices

- **Reference prices**, also referred to as **price benchmarks**, are used in determining trade prices for execution strategy and in calculating **actual trade costs** for post-trade evaluation purposes.
- **Categories of reference prices**
  - Pre-trade benchmarks
  - Intraday benchmarks
  - Post-trade benchmarks
  - Price target benchmarks

Reference Prices

- **Pre-trade benchmarks**, where the reference price for the benchmark is known before trading begins.
  - **Decision price**
    - ✓ **Quantitative portfolio managers** will often have **records** of their decision price because these prices may be **inputs** into their quantitative models.
  - **Previous close**
    - ✓ A previous close benchmark is often specified by **quantitative portfolio managers** who incorporate the previous close in a quantitative model, portfolio optimizer, or screening model.
    - ✓ The previous close is often used as a proxy for the decision price by **quantitative portfolio managers.**

Reference Prices

- **Pre-trade benchmarks**, where the reference price for the benchmark is known before trading begins.
  - **Opening price**
    - ✓ This benchmark price is most often specified by portfolio managers who begin trading at the market open and wish to **minimize trading costs**.
    - ✓ The opening price is often used as a proxy for the decision price by **fundamental portfolio managers** who are investing in a security for long-term alpha or growth potential.
    - ✓ The opening price does **not** have associated **overnight risk**, or the risk that prices will **adjust at market open** to incorporate information released after the close of the previous business day.
    - ✓ If the trade is to be executed in the opening auction, then using the opening price as a reference benchmark is not appropriate because the trade itself can influence the reference benchmark.

Reference Prices

- **Pre-trade benchmarks**, where the reference price for the benchmark is known before trading begins.
  - **Arrival price**.
    - ✓ The arrival price is the price of the security at the time the order is entered into the market for **execution**.
    - ✓ In these cases, the portfolio manager's goal is to transact at or close to **current market prices**.
    - ✓ Portfolio managers who are buying or selling on the basis of **alpha expectations** or a **current market mispricing** will often specify an arrival price benchmark (greater trade urgency).

Reference Prices

- **Intraday benchmarks**, where the reference price for the benchmark is computed on the basis of market prices that occur during the trading period.
- Managers **without views on short-term price movements** who wish to participate in volumes **over the execution horizon** typically use an intraday benchmark, such as VWAP or TWAP.
  - **Volume-weighted average price (VWAP)**
    - ✓ Portfolio managers who are **rebalancing** their portfolios **over the day** and have both buy and sell orders may select the VWAP as a price benchmark.
      - ◆ Doing so allows the portfolio managers to structure their executions over time to ensure cash received from sell orders is sufficient to fund remaining buy orders.

Reference Prices

- **Intraday benchmark**
  - **Time-weighted average price (TWAP)**
    - ✓ An **equal-weighted average price** of all trades executed over the day.
    - ✓ Portfolio managers may choose TWAP when they wish to **exclude potential trade outliers.**
      - ◆ Trade outliers may be caused by trading a large buy order at the day's low or a large sell order at the day's high.
      - ◆ If market participants are not able to fully participate in these trades, then TWAP may be a more appropriate choice.
    - ✓ The TWAP benchmark is used by portfolio managers and traders to evaluate fair and reasonable trading prices in market environments with **high volume uncertainty** and for securities that are **subject to spikes in trading volume** throughout the day.

Reference Prices

- **Post-trade benchmarks**, where the reference price for the benchmark is established after trading is completed.
  - **Closing price**.
    - ✓ Portfolio managers for funds **valued at the closing price** on the day or who wish to **minimize tracking error** to an underlying benchmark price, such as index funds, often select a post-trade reference price, such as the official closing price.
    - ✓ **Advantage**: minimizes potential tracking error.
    - ✓ **Disadvantage**: not known until after trading is completed.

Reference Prices

- **Price target benchmarks**, where the reference price for the benchmark is specified as a price to meet or beat (transact more favorably).
  - Portfolio managers **seeking short-term alpha** may select an alternative benchmark known as a price target benchmark.
  - In this case, a portfolio manager would like to transact in a security—believed to be undervalued or overvalued—at a **more favorable price**.

Trade Strategies

- The **primary goal** of a trading strategy is to **balance the expected costs, risks, and alpha** associated with trading the order in a manner consistent with the portfolio manager's trading objectives, risk aversion, and other known constraints. Trading strategies involving equities, fixed income, currency, and derivatives are explained as follows:
  - **Short-term alpha**: short-term alpha-driven equity trade (high trade urgency).
  - **Long-term alpha**: long-term alpha-driven fixed-income trade (low trade urgency).
  - **Risk rebalance**: buy/sell basket trade to rebalance a fund's risk exposure.
  - **Cash flow driven**: client redemption trade to raise proceeds.
  - **Cash flow driven**: cash equitization (derivatives) trade to invest a new client mandate.

Trade Execution (Strategy Implementation)

- **Trade Implementation Choices**
- **Algorithmic Trading**
  - Execution Algorithm Classifications
    - ✓ Scheduled (POV, VWAP, TWAP)
    - ✓ Liquidity seeking
    - ✓ Arrival price
    - ✓ Dark strategies/liquidity aggregators
    - ✓ Smart order routers
- **Comparison of Markets**
  - Equities
  - Fixed Income
  - Exchange-Traded Derivatives
  - Over-the-Counter Derivatives
  - Spot Foreign Exchange (Currency)

Trade Implementation Choices

- A variety of implementation choices are available based on the **specific order**, **market**, and **trade strategy** involved.
- The **higher-touch approaches** involve greater degrees of human interaction for order completion.
  - In **principal trades**, the executing broker assumes all or part of the risk related to trading the order, pricing it into her quoted spread.
  - In **agency trades**, the broker is engaged to find the other side of the trade but acts as an agent only, and risk for trading the order remains with the buy-side portfolio manager or trader.
  - Trading **in large blocks of securities** requires a higher-touch approach.
    - ✓ Markets characterized by dealer-provided quotes may be referred to as quote-driven, over-the-counter, or off-exchange markets.
      - ◆ A variation of quote-driven markets often used to trade less liquid securities is a **request for quote (RFQ)**.

Trade Implementation Choices

- For **straightforward trades in liquid securities**, low-touch automated execution strategies are often preferred.
  - Alternative trading systems (ATS) *multilateral trading facilities (MTF)* Non-exchange trading venues that bring together buyers and sellers to find transaction counterparties.
  - Direct market access (DMA) gives all market participants a way to interact directly with the order book of an exchange, usually through a broker's exchange connectivity.
  - Dark pools.

Algorithmic Trading

- **Algorithmic trading** is the computerized execution of the investment decision following a specified set of trading instructions.
- Trading algorithms are primarily used for **two purposes**—trade execution and profit generation.
  - **Execution algorithms**. An execution algorithm is tasked with transacting an investment decision made by the portfolio manager.
    - ✓ The manager determines what to buy or sell on the basis of his investment style and investment objective and then enters the order into the algorithm.
  - **Profit-seeking algorithms**. A profit-seeking algorithm will determine what to buy and sell and then implement those decisions in the market as efficiently as possible.
    - ✓ Profit-seeking algorithms are used by electronic market makers, quantitative funds, and high-frequency traders.

Execution Algorithm Classifications

- **Scheduled (POV,** VWAP, TWAP**)**
  - Scheduled algorithms are **appropriate** for orders in which portfolio managers or traders do **not** have expectations of adverse price movement during the trade horizon.
  - **POV** (percentage of volume) algorithms (also known as participation algorithms) send orders following a volume participation schedule.
    - ✓ **Advantage**
      - ◆They will automatically take advantage of increased liquidity conditions by trading more shares when there is ample market liquidity and will not trade in times of illiquidity.
    - ✓ **Disadvantage**
      - ◆may incur **higher trading costs** by continuing to buy as prices move higher and to sell as prices move lower.
      - ◆**may not complete** the order within the time period specified.

Execution Algorithm Classifications

- **Scheduled (**POV, **VWAP,** TWAP**)**
- VWAP and TWAP algorithms release orders to the market following a **time-specified schedule**, trading a predetermined number of shares within the specified time interval.
  - **VWAP algorithms** slice the order into smaller amounts to send to the market following a time slicing schedule based on historical intraday **volume profiles**.
  - These algorithms typically trade a **higher percentage** of the order at the **open and close** and a smaller percentage of the order during midday. Because of this, the VWAP curve is said to resemble a **U-shaped curve.**
  - Following a fixed schedule as VWAP algorithms do may not be optimal for illiquid stocks because such algorithms may **not complete** the order in cases where volumes are low.

Execution Algorithm Classifications

- **Scheduled (**POV, VWAP, **TWAP)**
  - **TWAP algorithms** slice the order into smaller amounts to send to the market following an **equal-weighted time schedule**.
    - ✓ An **advantage** of a time slicing strategy is that it **ensures** the specified number of shares are executed within the specified time period.
    - ✓ A **disadvantage** of a time slicing strategy is that it will force the trades even in times of insufficient liquidity and will **not take** advantage of increased liquidity conditions when available.

Execution Algorithm Classifications

- **Liquidity seeking**
  - **Liquidity-seeking algorithms**, also referred to as opportunistic algorithms, take advantage of market liquidity across multiple venues by **trading faster** when liquidity exists at a favorable price.
    - ✓ " liquidity sweeping" or "sweeping the book", dark pools
  - Liquidity-seeking algorithms are **appropriate** for large orders that the portfolio manager or trader would like to **execute quickly without** having a **substantial impact** on the security price.

Execution Algorithm Classifications

- **Arrival price**
  - **Arrival price algorithms** seek to **trade close to current market prices** at the time the order is received for execution.
  - Arrival price algorithms will trade more aggressively at the beginning of trading to execute more shares nearer to the arrival price, known as a **front-loaded strategy**.
    - ✓ time schedule based or volume participation based
  - Arrival price algorithms are **used for** orders in which the portfolio manager or trader believes **prices are likely to move unfavorably during the trade horizon**.

Execution Algorithm Classifications

- **Dark strategies/liquidity aggregators**
  - **Dark aggregator algorithms** execute shares away from "lit" markets, these algorithms execute in opaque, or less transparent, trade venues, such as dark pools.
  - Dark aggregator algorithms are **used** in trading when portfolio managers and traders are concerned with **information leakage** that may occur from posting limit orders in **lit venues** with pre- and post-trade transparency.
  - These algorithms are **appropriate** for:
    - ✓ order size is large relative to the market
    - ✓ trading securities that are relatively illiquid or have relatively wide bid–ask spreads
    - ✓ does not need to execute the order in its entirety

Execution Algorithm Classifications

- **Smart order routers (SORs)**
  - The SOR will determine the destination with the **highest probability of executing** the limit order and the venue with the **best market price**.
  - SORs **continuously monitor** market conditions in real time in both lit and dark markets.
  - SORs are used when a portfolio manager or trader wishes to execute a small order by routing the order into the market as either a **market(able)** or **non-marketable (limit) order**.
    - ✓ **Market orders**. SORs are used for orders that are sufficiently small that they will not have a large market impact if sent as marketable orders.
    - ✓ **Limit orders.** SORs are also used for orders that are small enough that posting the order as a limit order will not leak information to the market and move prices.

Comparison of Markets

- **Equities**
  - Equities are generally **traded on exchanges and dark pools**.
    - ✓ **Exchanges** are known as lit markets (as opposed to dark markets) because they provide pre-trade transparency—namely, limit orders that reflect trader intentions for trade side (buy or sell), price, and size.
    - ✓ **Dark pools** provide anonymity because no pre-trade transparency exists.
  - **Trade implementation choices.** Equities are the **most technologically advanced market**.
    - ✓ **Large, urgent trades**, particularly in less liquid small-cap stocks, are generally executed as **high-touch broker risk trades**, where the broker acts as dealer and counterparty.
    - ✓ **Large, non-urgent trades** may be executed using trading algorithms (particularly for more liquid large-cap stocks) or, for less liquid securities, a high-touch agency approach.
    - ✓ For **small trades** in liquid securities, most buy-side traders use electronic trading.

Comparison of Markets

- **Fixed income**
  - Fixed-income securities are generally traded **not** on exchanges but in a bilateral, dealer-centric market structure where **dealers** make markets in the securities. (relatively **illiquid, off-the-run** bonds).
  - **Trade implementation choices**
    - ✓ There is **limited algorithmic trading** in bond markets, except for on-the-run (most recently issued) US Treasuries
    - ✓ For other fixed-income instruments, **high-touch trading** persists, particularly for larger trades and less liquid securities.
      - ◆**Small trades and large, urgent trades** are usually implemented through broker risk trades (via RFQs), (principal trades).
      - ◆**Large, non-urgent trades** are generally implemented using a high-touch approach, (agency trades instead of).

Comparison of Markets

- **Exchange-traded derivatives (options and futures)**
  - Most of the trading volume in exchange-traded derivatives is concentrated in **futures**.
  - **Trade implementation choices**
    - ✓ **Electronic trading** is pervasive, and **algorithmic trading** is growing.
    - ✓ **Large, urgent trades** "sweep the book" where market depth is relatively good.
      - ◆In these cases, trades are executed against the most aggressive limit orders on the other trade side first and then against decreasingly aggressive limit orders until the entire order has been filled.
    - ✓ **Large, non-urgent trades** are generally implemented electronically through **trading algorithms**.
    - ✓ Buy-side traders generally use **direct market access**, particularly for **small trades**.

Comparison of Markets

- **Off-exchange (OTC) derivatives**
  - OTC derivative markets have historically been **opaque**, with little public data about prices, trade sizes, and structure details.
  - **Large, urgent trades** are generally implemented as broker risk trades, where risk is transferred to a broker who takes the contract into his inventory.
  - **Large, non-urgent trades** are generally implemented using a high-touch agency trade, where the broker attempts to match buyers and sellers directly.
- **Spot Foreign Exchange (Currency)**
  - For large, urgent trades, RFQs are generally submitted to multiple dealers competing for a trade.
  - Large, non-urgent trades are mostly executed using algorithms (such as TWAP) or a high-touch agency approach.
  - Small trades are usually implemented using DMA.

Trade Evaluation

- **Trade Cost Measurement**
  - Implementation Shortfall
  - Expanded Implementation Shortfall
- **Evaluating Trade Execution**
  - Arrival price
  - VWAP
  - TWAP
  - Market on Close
  - Market-adjusted Cost
  - Added Value

Implementation Shortfall

- The **implementation shortfall** measure is the standard for measuring the **total cost** of the trade. IS compares a portfolio's **actual return** with its **paper return** (where transactions are based on decision price).
  - The paper return shows the **hypothetical return** that the fund would have received if the manager were able to transact **all shares at the desired decision price** and **without any associated costs or fees** (with no friction).
  - **IS = Paper return – Actual return**

Implementation Shortfall

- **Paper return** $= (\boldsymbol{P_n} - \boldsymbol{P_d})(\boldsymbol{S}) = (\boldsymbol{S})(\boldsymbol{P_n}) - (\boldsymbol{S})(\boldsymbol{P_d})$
  - S represents the total order shares
    - ✓ S > 0 indicates a buy order
    - ✓ S < 0 indicates a sell order
  - P_d represents the price at the time of the investment decision
  - P_n represents the current price
- **Actual return** $= (\sum s_j)(\boldsymbol{P_n}) - \sum s_j p_j - \boldsymbol{Fees}$
  - s_j and p_j represent the number of shares executed and the transaction price of the jth trade
  - $\sum s_j$ represents the total number of shares of the order that were executed in the market
  - "Fees" includes all costs paid by the fund to complete the order

Implementation Shortfall

- This IS formulation decomposes the total cost of the trade into three categories: **execution cost (Delay cost, Trading cost), opportunity cost, and fixed fees**.
  - **Execution cost** occurs from the buying and/or selling pressure of the order, which often causes buy orders to become **more expensive** and sell orders to **decrease in value**, thus causing the fund to incur **higher costs** and **lower realized returns**.
    - ✓ Wagner (1991) further expanded the IS measure to **decompose** the execution cost component into **a delay-related cost** component and **a trading-related cost** component.
    - ✓ **Delay cost** arises when the order is **not submitted** to the market in a **timely** manner and the asset experiences **adverse price movement**, making it more expensive to transact.

Implementation Shortfall

- **Opportunity cost** corresponds to the **unexecuted shares** of the order. It is the cost associated with **not** being able to transact the **entire order** at the manager's decision price and is due to **adverse price movement** over the trading period.
- The **fixed fees** component includes **all explicit fees**, such as commissions, exchange fees, and taxes.

➢ **IS formulation**

- **IS = Execution cost + Opportunity cost + Fees**

➢ **Expanded Implementation Shortfall**

- **Expanded IS = Delay cost + Trading cost + Opportunity cost + Fees**

Implementation Shortfall

- **IS** = $\underbrace{\sum s_j \, p_j - \sum s_j \, P_d}_{\text{Execution cost}} + \underbrace{\left(S - \sum s_j\right)(P_n - P_d)}_{\text{Opportunity cost}} + Fees$

- **Expanded IS** =

$$\underbrace{\underbrace{(\sum s_j)P_0 - (\sum s_j)\, P_d}_{\text{Delay cost}} + \underbrace{\sum s_j \, p_j - \left(\sum s_j\right)P_0}_{\text{Trading cost}}}_{\text{Execution cost}} + \underbrace{\left(S - \sum s_j\right)(P_n - P_d)}_{\text{Opportunity cost}} + Fees$$

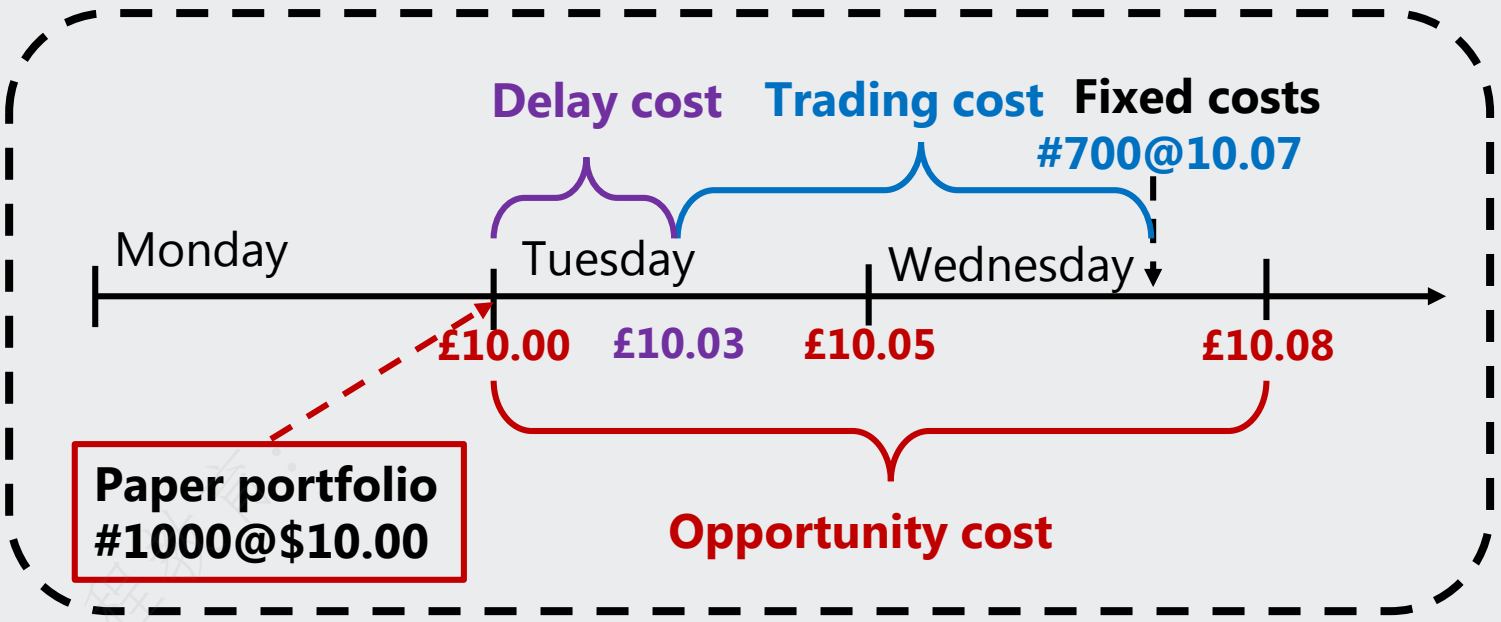
P_0 represents the arrival price

Example

- On Monday, the shares of Impulse Robotics close at £10.00 per share.
- On Tuesday, before trading begins, a portfolio manager decides to buy Impulse Robotics. An order goes to the trading desk to buy 1,000 shares of Impulse Robotics at £9.98 per share or better, good for one day. The **benchmark price** is Monday's close at £10.00 per share. No part of the limit order is filled on Tuesday, and the order expires. The closing price on Tuesday rises to £10.05.
  - Additional: The buy-side trading desk releases the order to the market 30 minutes after receiving it, when the price is £10.03.
- On Wednesday, the trading desk again tries to buy Impulse Robotics by entering a new limit order to buy 1,000 shares at £10.07 per share or better, good for one day. During the day, 700 shares are bought at £10.07 per share. Commissions and fees for this trade are £14. Shares for Impulse Robotics close at £10.08 per share on Wednesday.
- No further attempt to buy Impulse Robotics is made, and the remaining 300 shares of the 1,000 shares the portfolio manager initially specified are canceled.

Example

- **Solution:**
- We can break this IS down further, as follows:



- **Delay cost**, which reflects the adverse price movement associated with not submitting the order to the market in a timely manner and is based on the amount of shares executed in the order: (700 × £10.03) – (700 × £10.00) = £7,021 – £7,000 = £21.

Example

- **Trading cost**, which reflects the execution price paid on shares executed: (700 × £10.07) – (700 × £10.03) = £7,049 – £7,021 = £28.
- **Opportunity cost**, which is based on the amount of shares left unexecuted and reflects the cost associated with not being able to execute all shares at the decision price: (1,000 shares – 700 shares) × (£10.08 – £10.00) = £24.
- **Fixed fees**, which are equal to total explicit fees paid: £14.
- Therefore, expanded implementation shortfall (£) = £21 + £28 + £24 + £14 = £87.
- The expanded IS provides further insight into the causes of trade costs. The delay cost is £21, which accounts for 24.1% (£21/£87) of the total IS cost, whereas the opportunity cost of £24 accounts for 27.6% (£24/£87) of the total IS cost. Quite often, delay cost and opportunity cost account for the greatest quantity of cost during implementation. These costs can often be eliminated with proper transaction cost management techniques.

Implementation Shortfall

- **Improving Execution Performance**
  - **Delay costs** can be **reduced** by having **a process** in place that provides traders with **broker performance metrics**.
    - ✓ In theory, the delay cost component should have an expected value of zero.
  - Portfolio managers can use IS to help determine **appropriate order size** for the market within the portfolio manager's price range and to **minimize the opportunity cost** of the order.
    - ✓ Opportunity cost is not mean zero and often represents a cost to the fund. This is due to two reasons:
      - ◆adverse price movement
      - ◆illiquidity.

Example

- A portfolio manager decides to buy 100,000 shares of RLK at 9:00 a.m., when the price is $30.00. He sets a limit price of $30.50 for the order. The buy-side trader does not release the order to the market for execution until 10:30 a.m., when the price is $30.10. The fund is charged a commission of $0.02/share and no other fees. At the end of the day, 80,000 shares are executed and RLK closes at $30.65. Order and execution details are summarized as follows:

Order	
Stock Ticker	RLK
Side	Buy
Shares	100,000
Limit Price	$30.50

Trades	**Execution Price**	**Shares Executed**
Trade 1	$30.20	30,000
Trade 2	$30.30	20,000
Trade 3	$30.40	20,000
Trade 4	$30.50	10,000
Total		80,000

Example

a. Calculate execution cost.
b. Calculate opportunity cost.
c. Calculate fixed fees.
d. Calculate implementation shortfall in basis points.
e. Discuss how opportunity cost could be minimized for the trade.
f. Calculate delay cost.
g. Calculate trading cost.
h. Show expanded implementation shortfall in basis points.
i. Discuss how delay cost could be minimized for the trade.

Example

Solution:

a. **Execution cost** is calculated as the difference between the costs of the real portfolio and the paper portfolio. It reflects the execution price(s) paid for the amount of shares in the order that were actually filled, or executed. Execution cost can be calculated as follows:

$$\begin{aligned}&\textbf{Execution cost}\\&=(30{,}000\times\$30.20+20{,}000\times\$30.30+20{,}000\times\$30.40+10{,}000\times\$30.50)-\\&\quad 80{,}000\times\$30.00\\&=\$2{,}425{,}000-\$2{,}400{,}000\\&=\$25{,}000\end{aligned}$$

b. **Opportunity cost** is based on the amount of shares left unexecuted in the order and reflects the cost of not being able to execute all shares at the decision price. Opportunity cost can be calculated as follows:

$$\begin{aligned}\text{Opportunity cost} &= (100{,}000-80{,}000)(\$30.65-\$30.00)\\&=\$13{,}000\end{aligned}$$

Example

Solution:

c. Fixed fees are equal to total explicit fees paid and can be calculated as follows:

Fees = 80,000 × $0.02 = $1,600

d. Implementation shortfall can be calculated as follows:

Implementation shortfall ($) = $25,000+$13,000+$1,600
= $39,600

The implementation shortfall is expressed in basis points as follows:

$$\text{Implementation shortfall (bps)} = \frac{\text{Implementation shortfall (\$)}}{(\text{Total shares})(P_d)} \times 10{,}000 \text{ bps}$$

$$= 132 \text{ bps}$$

Example

Solution:

e. **Minimizing opportunity cost**: Based on the decomposition of IS, the portfolio manager incurred an opportunity cost of $13,000 on 20,000 shares. The opportunity cost could be lowered by reducing order quantity to a size that can be absorbed into the market at the portfolio manager's price target or better. In this example, opportunity cost represented 32.8% ($13,000/$39,600) of the total IS cost. If the portfolio manager had known this in advance, he could have reduced the size of the order to 80,000 shares and invested the extra $600,000 (20,000 shares × $30.00/share = $600,000) in his second most attractive investment opportunity.

f. **Delay cost** can be calculated as follows:

$$\text{Delay cost} = 80{,}000 \times \$30.10 - 80{,}000 \times \$30.00 = \$8{,}000$$

Example

Solution:

g. Trading cost can be calculated as follows:

Trading cost

$=(30{,}000\times\$30.20+20{,}000\times\$30.30+20{,}000\times\$30.40+10{,}000\times\$30.50)-80{,}000\times\$30.10$

$=\$2{,}425{,}000-\$2{,}408{,}000$

$=\$17{,}000$

h. Expanded implementation shortfall can be calculated as follows:

Expanded IS = Delay cost + Trading cost + Opportunity cost + Fees

= \$8,000 + \$17,000 + \$13,000 + \$1,600 = 39,600

The delay cost is \$8,000, which accounts for 20.2% (\$8,000/\$39,600) of the total IS cost, whereas the opportunity cost of \$13,000 accounts for 32.8% (\$13,000/\$39,600) of the total IS cost.

Example

Solution:

i. **Minimizing delay cost**: The delay cost of $8,000 accounts for a sizable portion (20.2%) of the total IS cost and could be minimized by having a process in place that provides the buy-side trader with broker performance metrics. This would allow the trader to quickly identify the best broker and/or algorithm to execute the order given its characteristics and current market conditions, thereby minimizing the time between order receipt and market execution.

Evaluating Trade Execution

- Trade evaluation measures the **execution quality** of the trade and the performance of the trader, broker, and/or algorithm used.
- Various techniques measure trade cost execution using different benchmarks (**pre-trade, intraday, and post-trade**).
- Trade cost analysis enables investors to better manage trading costs and understand where trading activities can be improved through the use of appropriate trading partners and venues.
- Trade cost calculations are expressed such that a **positive value** indicates **underperformance** and represents underperformance compared with the benchmark. **A negative value** indicates a savings and is a **better performance** compared with the benchmark.

Evaluating Trade Execution

- **Cost in total dollars ($)**

$$Cost\ (\$) = Side \times (\overline{P} - P^*) \times Shares$$

- **Cost in dollars per share ($/share)**

$$Cost\ (\$/share) = Side \times (\overline{P} - P^*)$$

- **Cost in basis points (bps)**

$$Cost\ (bps) = Side \times \frac{(\overline{P} - P^*)}{P^*} \times 10{,}000\ bps$$

  - Side: +1 Buy order ; -1 Sell order
  - $\overline{P}$ = Average execution price of order
  - P^* = Reference price
  - Shares = Shares executed

Evaluating Trade Execution

➢ Arrival Price

- The arrival price benchmark measures the difference between the **market price** (P_0) at the time the order was released to the market and the **actual transaction price** for the fund.
- This benchmark is used to measure the **trade cost of the order** incurred while the order was being executed in the market.

$$\text{Arrival cost (bps)} = Side \times \frac{(\overline{P} - P_0)}{P_0} \times 10^4 \ bps$$

Evaluating Trade Execution

➢ VWAP

- Portfolio managers use the VWAP benchmark as a measure of whether they received **fair** and **reasonable prices** over the trading period.
- Since the VWAP comprises all market activity over the day, all buying and selling pressure of all other market participants, and market noise, it provides managers with a reasonable indication of the **fair cost** for market participants over the day.

$$\text{VWAP cost (bps)} = Side \times \frac{(\overline{P} - VWAP)}{VWAP} \times 10^4 \ bps$$

Evaluating Trade Execution

- **TWAP**
  - The TWAP benchmark is an **alternative measure** to determine whether the fund achieved **fair** and **reasonable prices** over the trading period and is used when managers wish to **exclude** potential trade price **outliers**.

$$\text{TWAP cost (bps)} = Side \times \frac{(\overline{P} - TWAP)}{TWAP} \times 10^4 \ bps$$

Evaluating Trade Execution

- **Market on Close**
  - The closing benchmark, also referred to as an **MOC** benchmark, is used primarily by **index managers** and **mutual funds** that wish to achieve the closing price on the day and compare their actual transaction prices with the closing price.
    - ✓ Doing so ensures that the benchmark cost measure will be **consistent** with the **valuation of the fund**.
    - ✓ The closing price benchmark is also the benchmark that is **consistent** with the **tracking error calculation**.

$$\text{Close (bps)} = Side \times \frac{(\overline{P} - Close)}{Close} \times 10^4 \; bps$$

Evaluating Trade Execution

- **Market-Adjusted Cost**
  - The market-adjusted cost is a performance metric used by managers and traders to help **separate** the **trading cost** due to trading the order from the **general market movement** in the security price.
  - The market-adjusted cost is calculated by subtracting the market cost due to market movement adjusted for order side from the total arrival cost of the trade.

Market-adjusted cost (bps)=Arrival cost (bps) – β × Index cost (bps)

Where,

β represents the stock's beta to the underlying index

$$\text{Index cost (bps)} = Side \times \frac{(Index\ VWAP - Index\ arrival\ price)}{Index\ arrival\ price} \times 10^4\ bps$$

Example

- A portfolio manager executes a sell order at an average price of $29.50. The arrival price at the time the order was entered into the market was $30.00. The selected index price at the time of order entry was $500, and market index VWAP over the trade horizon was $495. The stock has a beta to the index of 1.25.
  1. Calculate arrival cost.
  2. Calculate index cost.
  3. Calculate market-adjusted cost.

Example

Solutions:

1. Calculate arrival cost.

$$\text{Cost (bps)} = \text{Side} \times \frac{(\overline{P} - P_0)}{P_0} \times 10{,}000 \text{ bps}$$

$$= -1 \times \frac{\$29.5 - \$30.00}{\$30.00} \times 10{,}000 \text{ bps}$$

$$= 166.7 \text{ bps}$$

- In this example, the arrival cost is calculated to be +166.7 bps, indicating that the order underperformed the arrival price.
- Although this is true, much of the adverse prices were likely due to market movement rather than inferior performance from the broker or algorithm.
- This sell order was executed in a falling market, which resulted in an arrival cost of 166.7 bps for the investor.

Example

Solution:

2. Calculate index cost.

$$\text{Cost (bps)} = \text{Side} \times \frac{(Index\ VWAP - Index\ arrival\ price)}{Index\ arrival\ price} \times 10{,}000 \text{ bps}$$

$$= -1 \times \frac{\$495 - \$500}{\$500} \times 10{,}000 \text{ bps}$$

$$= 100 \text{ bps}$$

3. Calculate market-adjusted cost.

Market-adjusted cost (bps) = Arrival cost (bps) – β × Index cost (bps)

= 166.7 bps – 1.25 × 100 bps

= 166.7 bps – 125 bps

= 41.7 bps

However, an estimated 125 bps of this cost was due to market movement, which would have occurred even if the order had not traded in the market.

Thus, the market-adjusted cost for this order is 41.7 bps.

Evaluating Trade Execution

- **Added Value**
  - Another methodology used by investors to evaluate trading performance is to compare the **arrival cost** of the order with the **estimated pre-trade cost**.
  - This metric helps fund managers understand the **value added** by their broker and/or execution algorithms during the execution of the order.
  - **Added value (bps) = Arrival cost (bps) – Est. pre-trade cost (bps)**

Example

- Consider the following facts. A portfolio manager executes a buy order at an average price of $\overline{P}$ = \$50.35. The arrival price at the time the order was entered into the market was P_0 = \$50.00. Prior to trading, the buy-side trader performs pre-trade analysis of the order and finds that the expected cost of the trade is 60 bps, based on information available prior to trading. The pre-trade adjustment is calculated as follows:

- **Solutions：**
  - Arrival cost (bps) $= Side \times \frac{(\overline{P} - P_0)}{P_0} \times 10^4\ bps$

    $= +1 \times \frac{(50.35 - 50)}{50} \times 10^4\ bps$ = 70bps
  - Added value = Arrival cost - Est. pre-trade cost

    =70-60=10bps
  - The pre-trade adjusted cost in this example is 10 bps, indicating that the fund underperformed pre-trade expectations by 10 bps.

Trade Governance

- Major regulators mandate that asset managers have in place **a trade policy document** that clearly and comprehensively articulates a firm's **trading policies** and **escalation procedures**.
- The objective of a trade policy is to ensure the asset manager's execution and order-handling procedures are **in line with their fiduciary duty** owed to clients for **best execution**.
- A **trade policy document** needs to incorporate the following **key aspects**:
  - Meaning of best execution;
  - Factors determining the optimal order execution approach;
  - Handling trading errors;
  - Listing of eligible brokers and execution venues;
  - A process to monitor execution arrangements.

Trade Governance

- **Meaning of Best Order Execution within the Relevant Regulatory Framework**
  - execution price
  - trading costs
  - speed of execution
  - likelihood of execution and settlement
  - order size
  - nature of the trade
  - Rather than simply trying to obtain the best price at the lowest possible trading cost, best execution involves identifying the most appropriate **trade-off** between these aspects.

Trade Governance

- **Factors Used to Determine the Optimal Order Execution Approach**
  - Urgency of an order
  - Characteristics of the securities traded
  - Characteristics of the execution venues used
  - Investment strategy objectives
  - Rationale for a trade

Trade Governance

- **List of Eligible Brokers and Execution Venues**
  - Quality of service
  - Financial stability
  - Reputation
  - Settlement capabilities
  - Speed of execution
  - Cost competitiveness
  - Willingness to commit capital

Trade Governance

- **Process Used to Monitor Execution Arrangements**
  - **Checkpoints** for trade execution monitoring include the following:
    - ✓ Trade submission
    - ✓ What was the execution quality of a trade relative to its benchmark?
    - ✓ Is there an appropriate balance between trading costs and opportunity costs?
    - ✓ Could better execution have been achieved using a different trading strategy, different intermediaries, or different trading venues?
  - **Trading records** and the evaluation of those records
    - ✓ Address client concerns
    - ✓ Address regulator concerns
    - ✓ Assist in improving execution quality
    - ✓ Monitor the parties involved in trading/order execution
  - These policies and procedures should be outlined in a comprehensive document and **reviewed regularly** (for example, quarterly) and when the need arises.

Reading 26

Portfolio Performance Evaluation

Framework

1. The Components of Performance Evaluation
2. Performance Attribution
   - Approaches to Return Attribution
   - Return Attribution Analysis at Multiple Levels
   - Risk Attribution
3. Benchmarking Investments and Managers
4. Performance Appraisal

Approaches to Return Attribution

- **Return attribution** is a set of techniques used to identify the sources of excess return of a portfolio against its benchmark, quantifying the consequences of active investment decisions.
  - **Arithmetic attribution** approaches
    - ✓ Arithmetic difference = R – B.
      - ◆R=portfolio return
      - ◆B=benchmark return
    - ✓ Arithmetic approaches are straightforward for a single period.
    - ✓ However, when combining multiple periods, the sub-period attribution effects will **not** sum to the excess return.
  - **Geometric attribution** approaches extend the arithmetic approaches by attributing the geometric excess return (G), as defined below:

$$G = \frac{1+R}{1+B} - 1 = \frac{R-B}{1+B}$$

    - ✓ In a geometric attribution approach, the attribution effects will compound (multiply) together to total the geometric excess return.
    - ✓ Works across multiple periods.

The Components of Performance Evaluation

- Performance evaluation includes **three primary components**, each corresponding to a specific question we need to answer to evaluate a portfolio's performance:
  - **Performance measurement** provides an overall indication of the portfolio's performance, typically relative to a benchmark.
    - ✓ what was the portfolio's performance?
  - **Performance attribution** builds on performance measurement to explain how the performance was achieved.
    - ✓ how was the performance achieved?
  - **Performance appraisal** leverages both returns and attribution to infer the quality of the investment process.
    - ✓ was the performance achieved through manager skill or luck?

Performance Attribution

- **Returns-based attribution**
  - Uses only the total portfolio returns over a period to identify the components of the investment process that have generated the returns.
  - Returns-based attribution is the **easiest method** to implement, but because it does **not** use the underlying holdings, it is the **least accurate** of the three approaches and the most vulnerable to data manipulation.
  - One might use **returns-based attribution** to evaluate hedge funds, because it can be **difficult to obtain the underlying holdings** of hedge funds.

Performance Attribution

- **Holdings-based** attribution uses the holdings over time to evaluate the decisions that contributed to the returns.
  - The accuracy of holdings-based attribution improves when using data with shorter time intervals (monthly, weekly, or daily).
  - Because holdings-based attribution **fails** to capture the impact of any transactions made during the measurement period, it may not reconcile to the actual portfolio return.
    - ✓ The residual caused by ignoring transactions might be described as a **timing or trading effect**.
  - **Holdings-based analysis** is **most appropriate** for investment strategies with **little turnover** (e.g., passive strategies).

Performance Attribution

- **Transactions-based** attribution uses both holdings and transactions to fully explain the performance over the evaluation period.
  - For transaction-based attribution, both the weights and returns reflect all transactions during the period, including transaction costs.
  - Transaction-based attribution is the **most accurate** type of attribution analysis but also the **most difficult and time-consuming** to implement.
  - To obtain meaningful results, the underlying data **must** be **complete**, **accurate**, and **reconciled from period to period**.

Return Attribution

- **Equity**
  - The Brinson Model
    - ✓ Brinson–Hood–Beebower (BHB) Model
      - ◆From an article written by Brinson, Hood, and Beebower (1986).
    - ✓ Brinson–Fachler (BF) Model
      - ◆From an article written by Brinson and Fachler (1985).
      - ◆The **BF model** is **more widely used** in performance attribution today.
  - Factor-Based Return Attribution (Carhart four-factor model)
- **Fixed Income**
  - Exposure decomposition—duration based
  - Yield curve decomposition—duration based
  - Yield curve decomposition—full repricing based

Equity Return Attribution

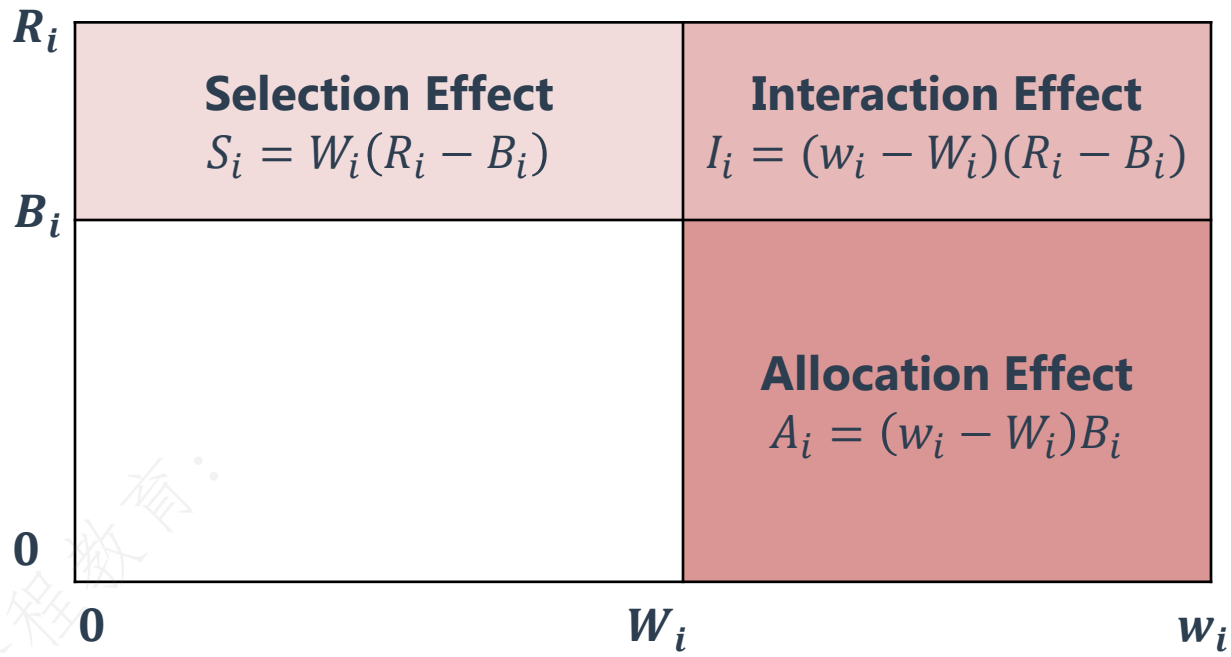
➢ Brinson–Hood–Beebower (BHB) Model

$$\text{Portfolio return R} = \sum_{i=1}^{i=n} w_i R_i \qquad \text{Benchmark return B} = \sum_{i=1}^{i=n} W_i B_i$$

- Where
  - ✓ w_i = weight of the ith sector in the portfolio
  - ✓ R_i = return of the portfolio assets in the ith sector
  - ✓ W_i = weight of the ith sector in the benchmark
  - ✓ B_i = return of the benchmark in the ith sector
  - ✓ n = number of sectors or securities

Equity Return Attribution

- **Brinson–Hood–Beebower (BHB) Model**



Equity Return Attribution

- **Brinson–Hood–Beebower (BHB) Model**
  - The **allocation effect** refers to the value the portfolio manager adds (or subtracts) by having portfolio **sector weights** that are different from the benchmark sector weights.

$$A_i = (w_i - W_i)B_i$$

  - **Total allocation effect**

$$A = \sum_{i=1}^{i=n} A_i$$

Equity Return Attribution

- **Brinson–Hood–Beebower (BHB) Model**
  - **Security selection** refers to the value the portfolio manager adds by holding **individual securities** or **instruments** within the sector in different-from-benchmark weights.

$$S_i = W_i(R_i - B_i)$$

  - **Total selection effect**

$$S = \sum_{i=1}^{i=n} S_i$$

Equity Return Attribution

- **Brinson–Hood–Beebower (BHB) Model**
  - The **interaction effect** is the effect resulting from the **interaction** of the allocation and selection decisions combined.

$$I_i = (w_i - W_i)(R_i - B_i)$$

  - **Total interaction effect**

$$I = \sum_{i=1}^{i=n} I_i$$

Example: The BHB Model

Interpreting the Results of a BHB Attribution

- Use the table above to answer the following questions.

BHB Attribution Analysis Results Table

Region	Portfolio Return	Benchmark Return	Portfolio Weight	Benchmark Weight	Allocation	Selection	Inter-action	Total
Americas	2.80%	1.20%	30%	30%	0.00%	0.48%	0.00%	0.48%
APAC	–1.50%	–0.50%	20%	30%	0.05%	–0.30%	0.10%	–0.15%
EMEA	0.70%	1.50%	50%	40%	0.15%	–0.32%	–0.08%	–0.25%
Total	**0.89%**	**0.81%**	**100%**	**100%**	**0.20%**	**–0.14%**	**0.02%**	**0.08%**

Example: The BHB Model

- 1 Why is the contribution to selection for Europe, the Middle East, and Africa (EMEA) negative?
  - A. The total benchmark return is less than the total portfolio return.
  - B. The manager selected securities in EMEA that underperformed the benchmark.
  - C. The manager underweighted an outperforming sector.
- 2 Why is the contribution to allocation for Asia Pacific (APAC) equal to +5 bps?
  - A. The benchmark weight and the portfolio weight are equal.
  - B. The manager has an overweight position in an overperforming region.
  - C. The manager has an underweight position in an underperforming region.

Example: The BHB Model

- 3 Which of the following conclusions from the above attribution analysis is most correct?
  - A. The manager's security selection decisions were better in the Americas than in APAC.
  - B. The manager's security selection decisions were better in EMEA than in APAC.
  - C. The manager's allocation decisions were better in APAC than in EMEA.
- 4 Which of the following conclusions from the above attribution analysis is most correct?
  - A. Overall, the manager made better allocation decisions than selection decisions.
  - B. Overall, the manager made better selection decisions than allocation decisions.
  - C. Contribution from interaction was most noticeable in the Americas.

Example: The BHB Model

- **Solution to 1:**

  B is correct. The manager selected securities that underperformed the benchmark, with a portfolio return for EMEA of 0.7% versus a benchmark return for EMEA of 1.5%.

- **Solution to 2:**

  C is correct. The manager is underweight in APAC, 20% versus a benchmark weight of 30%. The APAC portion of the portfolio underperformed, with a −0.50% benchmark return versus the total benchmark return of 0.81%.

Example: The BHB Model

- **Solution to 3:**
  A is correct. As reflected in the contribution to selection, the manager's security selection decisions were better in the Americas (0.48%) than in APAC (–0.30%).

- **Solution to 4:**
  A is correct. Overall, the manager made better allocation decisions (0.20%) than selection decisions (–0.14%).

Equity Return Attribution

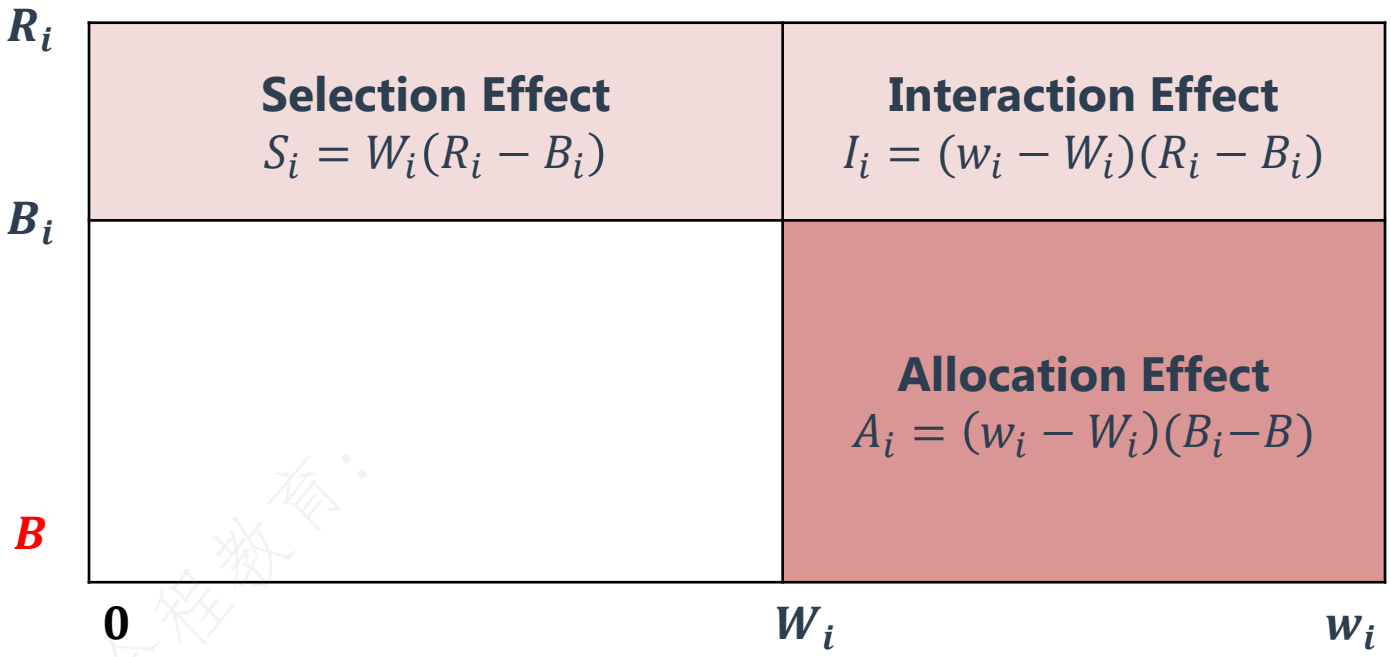
- **Brinson–Fachler (BF) Model**
  - The Brinson–Fachler (BF) model differs from the BHB model **only** in **individual sector allocation effects (A_i)** calculation.

$$A_i = (w_i - W_i)(B_i - B)$$

  - Where:
    - ✓ B = return of overall benchmark
  - **Total allocation effect (A)** calculated using BF model is **the same** as the result of the BHB model.

Equity Return Attribution

- **Brinson–Fachler (BF) Model**



Equity Return Attribution

- **Factor-Based Return Attribution (Carhart four-factor model)**

$$R_p - R_f = a_p + b_{p1}\text{RMRF} + b_{p2}\text{SMB} + b_{p3}\text{HML} + b_{p4}\text{WML} + E_p$$

  - where
    - ✓ R_p = the return on the portfolio
    - ✓ R_f = risk-free rate of return
    - ✓ a_p = "alpha" or return in excess of that expected given the portfolio's level of systematic risk (assuming the four factors capture all systematic risk)
    - ✓ b_p = the sensitivity of the portfolio to the given factor

Equity Return Attribution

- **Carhart four-factor model**
  - ✓ **RMRF** = the return on a value-weighted equity index in excess of the one-month T-bill rate
  - ✓ **SMB** = small minus big, a **size (market-capitalization) factor** (SMB is the average return on three small-cap portfolios minus the average return on three large-cap portfolios)
  - ✓ **HML** = high minus low, a **value factor** (HML is the average return on two high-book-to-market portfolios minus the average return on two low-book-to-market portfolios)
  - ✓ **WML** = winners minus losers, a **momentum factor** (WML is the return on a portfolio of the past year's winners minus the return on a portfolio of the past year's losers)
  - ✓ E_p = an **error term** that represents the portion of the return to the portfolio, p, not explained by the model

Example: Carhart four-factor model

- For example, using the Carhart factor model, we calculate the following results for a hypothetical manager.

	Factor Sensitivity				Contribution to Active Return	
	Portfolio	Benchmark	Difference	Factor Return	Absolute	Proportion of Total
Factor	(1)	(2)	(3)	(4)	(3) × (4)	Active
RMRF	0.95	1.00	–0.05	5.52%	–0.28%	–13.30%
SMB	–1.05	–1.00	–0.05	–3.35%	0.17%	8.10%
HML	0.40	0.00	0.40	5.10%	2.04%	98.40%
WML	0.05	0.03	0.02	9.63%	0.19%	9.30%
				A. Factor tilts return =	2.12%	102.40%
				B. Security selection =	–0.05%	–2.40%
				C. Active return (A + B) =	2.07%	100.00%

Example: Carhart four-factor model

- Let's first look at the analysis of the benchmark (column 2). The sensitivity to RMRF of 1 indicates that the assigned benchmark has average market risk, consistent with it being a broad-based index. The benchmark's negative sensitivity to SMB indicates a large-cap orientation. Assuming, of course, that the benchmark is a good fit for the manager's stated strategy, we can describe the approach as large cap without a value/growth bias (HML is zero) or a momentum bias (WML is close to zero).

Example: Carhart four-factor model

- Based on the factor sensitivities shown in column 1 (positive sensitivity to HML of 0.40) and the differences relative to the benchmark shown in column 3, we can see that the manager likely had a value tilt but was otherwise relatively neutral to the benchmark. We would expect the portfolio to hold more value-oriented stocks than the benchmark, and we would want to evaluate the contribution of this tilt.
- Positive active exposure to the HML factor—the bet on value stocks—contributed 204 bps to the realized active return, about 98% of the 207 bps of total realized active return. The manager's minor active exposures to small stocks and momentum also contributed positively to return, whereas the active exposure to RMRF was a drag on performance. However, because the magnitudes of the exposures to RMRF, SMB, and WML were relatively small, the effects of those bets were minor compared with the value tilt (HML).

Fixed-Income Return Attribution

- Fixed-income portfolios are driven by very different sources of risk, requiring attribution approaches that attribute returns to decisions made with respect to credit risk and positioning along the yield curve.
  - **Exposure decomposition—duration based**
  - **Yield curve decomposition—duration based**
  - **Yield curve decomposition—full repricing based**
- All three approaches can be applied to single-currency and multi-currency portfolios.

Fixed-Income Return Attribution

- **Exposure decomposition—duration based**
  - Exposure decomposition is a **top-down attribution approach,** including **portfolio duration bets, yield curve positioning or sector bets**, each relative to the benchmark.
    - ✓ **Exposure decomposition** relates to the decomposition of portfolio risk exposures by means of grouping a portfolio's component bonds by specified characteristics.
    - ✓ **Duration based** relates to the typical use of duration to represent interest rate exposure decisions.
  - Exposure decomposition using duration segments portfolios by their market value weight and assigns securities to duration buckets (i.e., exposure to different ranges of duration) based on the security's maturity. (similar to Brinson-type model)
  - The exposure decomposition approach is used primarily for marketing and client reports.

Fixed-Income Return Attribution

- **Yield curve decomposition—duration based**
  - The duration-based yield curve decomposition approach to fixed-income attribution can be either executed as a **top-down approach** or built **bottom-up** from the security level.
  - This approach is applied to both the portfolio and the benchmark to identify contributions to total return from changes in the yield to maturity (YTM).

    % Total return = % Income return + % Price return

    where % Price return ≈ – Duration × Change in YTM
  - Yield curve decomposition approach require **more data points** to calculate the separate absolute attribution analyses for the portfolio and the benchmark.
  - Yield curve decomposition approach is typically used when preparing reports for analysts and portfolio managers.

Fixed-Income Return Attribution

- **Yield curve decomposition—full repricing based**
  - Instead of estimating price changes from changes in duration and yields to maturity, bonds can be repriced from zero-coupon curves (spot rates).
  - This **bottom-up security-level repricing** can then be translated into a contribution to a security's return and aggregated for portfolios, benchmarks, and active management.
  - This full repricing attribution approach provides **more precise** pricing and allows for a broader range of instrument types and yield changes.
  - This approach is **complex** nature can make it **more difficult** and **costly** (more data-intensive) to administer operationally and can make the results more difficult to understand.
  - The full repricing approach is used primarily for fixed-income professionals.

Exposure Decomposition

Bucket	Duration
Short	Less than or equal to 5
Mid	Greater than 5 and less than or equal to 10
Long	Greater than 10

Exhibit 4 Sample Exposure Decomposition: Relative Positions of Portfolio and Benchmark

	Portfolio Weights				Portfolio Duration				Portfolio Contribution to Duration			
	Short	Mid	Long	Total	Short	Mid	Long	Total	Short	Mid	Long	Total
Government	10.00%	10.00%	20.00%	40.00%	4.42	7.47	10.21	8.08	0.44	0.75	2.04	3.23
Corporate	10.00%	20.00%	30.00%	60.00%	4.40	7.40	10.06	8.23	0.44	1.48	3.02	4.94
Total	20.00%	30.00%	50.00%	100.00%	4.41	7.42	10.12	8.17	0.88	2.23	5.06	8.17

	Benchmark Weights				Benchmark Duration				Benchmark Contribution to Duration			
	Short	Mid	Long	Total	Short	Mid	Long	Total	Short	Mid	Long	Total
Government	20.00%	20.00%	15.00%	55.00%	4.42	7.47	10.21	7.11	0.88	1.49	1.53	3.91
Corporate	15.00%	15.00%	15.00%	45.00%	4.40	7.40	10.06	7.29	0.66	1.11	1.51	3.28
Total	35.00%	35.00%	30.00%	100.00%	4.41	7.44	10.14	7.19	1.54	2.60	3.04	7.19

Exposure Decomposition

	Portfolio Weights				Portfolio Returns				Portfolio Contribution to Return			
	Short	Mid	Long	Total	Short	Mid	Long	Total	Short	Mid	Long	Total
Government	10.00%	10.00%	20.00%	40.00%	–3.48%	–5.16%	–4.38%	–4.35%	–0.35%	–0.52%	–0.88%	–1.74%
Corporate	10.00%	20.00%	30.00%	60.00%	–4.33%	–6.14%	–5.42%	–5.48%	–0.43%	–1.23%	–1.63%	–3.29%
Total	20.00%	30.00%	50.00%	100.00%	–3.91%	–5.81%	–5.00%	–5.03%	–0.78%	–1.74%	–2.50%	–5.03%

	Benchmark Weights				Benchmark Returns				Benchmark Contribution to Return			
	Short	Mid	Long	Total	Short	Mid	Long	Total	Short	Mid	Long	Total
Government	20.00%	20.00%	15.00%	55.00%	–3.48%	–5.16%	–4.38%	–4.34%	–0.70%	–1.03%	–0.66%	–2.39%
Corporate	15.00%	15.00%	15.00%	45.00%	–4.33%	–6.14%	–5.86%	–5.44%	–0.65%	–0.92%	–0.88%	–2.45%
Total	35.00%	35.00%	30.00%	100.00%	–3.84%	–5.58%	–5.12%	–4.83%	–1.35%	–1.95%	–1.54%	–4.83%

Exposure Decomposition

- From Exhibit 4, we can make the following inferences regarding the manager's investment decisions:
  - With a higher duration than the benchmark (8.17 compared with 7.19 for the benchmark), the manager likely expected the rates to fall and took a bullish position on long-term bonds (interest rates) by increasing exposure to the long end of the interest rate curve (e.g., investing 50% of the portfolio in the longest-duration bucket versus 30% for the benchmark).
  - Based on the overweight in the corporate sector (60% versus the 45% benchmark weight), the manager likely expected credit spreads to narrow. Notice that this bet increases the 4.94 contribution to duration of the corporate sector in the portfolio compared with the 3.28 contribution to duration for the benchmark. This allocation makes the portfolio more exposed to market yield fluctuations in the corporate sector.
  - The total portfolio return is –5.03%, relative to a total benchmark return of –4.83%, showing an underperformance of –0.20% over the period.

Exposure Decomposition

Exhibit 5 Sample Exposure Decomposition: Attribution Results

Duration Bucket	Sector	Duration Effect	Curve Effect	Total Interest Rate Allocation	Sector Allocation	Bond Selection	Total
	Government					0.00%	0.00%
Short	Corporate				0.04%	0.00%	0.04%
	Total	*0.4%*	*0.12%*	*0.52%*	*0.04%*	*0.00%*	***0.56%***
	Government					0.00%	0.00%
Mid	Corporate				–0.05%	0.00%	–0.05%
	Total	*0.23%*	*0.03%*	*0.26%*	*–0.05%*	*0.00%*	***0.21%***
	Government					0.00%	0.00%
Long	Corporate				–0.22%	0.13%	–0.09%
	Total	*–1.25%*	*0.37%*	*–0.88%*	*–0.22%*	*0.13%*	***–0.97%***
Total		***–0.62%***	***0.52%***	***–0.10%***	***–0.23%***	***0.13%***	***–0.20%***

Exposure Decomposition

- Using the results from Exhibit 5, we can draw the following conclusions about the investment decisions made by this manager:
  - The portfolio underperformed its benchmark by 20 bps.
  - 62 bps were lost by taking a long-duration position during a period when yields increased (benchmark returns were negative in each duration bucket).
  - 52 bps were gained as a result of changes in the shape of the yield curve. Given the manager's overweighting in the long-duration bucket, we can infer that the yield curve flattened.
  - 23 bps were lost because the manager overweighted the corporate sector during a period when credit spreads widened (the benchmark corporate returns in each duration bucket were less than the government returns in those same duration buckets).
  - 13 bps were added through bond selection.

Yield-Curve Decomposition

Exhibit 6 Yield Curve Decomposition—Duration Based: Active Return Contribution

Bond	Yield	Roll	Shift	Slope	Curva -ture	Spread	Specific	Residual	Total
Gov't. 5% 30 June 21	–0.19%	–0.04%	0.43%	0.01%	0.15%	0.00%	0.00%	–0.01%	0.35%
Gov't. 7% 30 June 26	–0.22%	–0.03%	0.71%	0.04%	0.04%	0.00%	0.00%	–0.03%	0.52%
Gov't. 6% 30 June 31	0.12%	0.01%	–0.48%	0.05%	0.09%	0.00%	0.00%	–0.01%	–0.22%
Corp. 5% 30 June 21	–0.11%	–0.02%	0.21%	0.05%	0.05%	0.04%	0.02%	–0.02%	0.22%
Corp. 7% 30 June 26	0.12%	0.01%	–0.35%	–0.02%	–0.02%	–0.07%	0.00%	0.02%	–0.31%
Corp. (B) 6% 30 June 31	–0.39%	–0.03%	1.41%	–0.26%	–0.11%	0.30%	0.00%	–0.04%	0.88%
Corp. (P) 6% 30 June 31	0.78%	0.06%	–2.82%	0.52%	0.33%	–0.60%	0.15%	–0.05%	–1.63%
Total	0.11%	–0.04%	–0.89%	0.39%	0.53%	–0.33%	0.17%	–0.14%	–0.20%
	Time:	*0.08%*	*Curve Movement:*		*0.03%*				

Note: There may be minor differences due to rounding in this table.

Yield-Curve Decomposition

- Using the data from Exhibits 4 and 6, we can infer the following about the portfolio investment process over this period:
  - ***Yield:*** The portfolio overweighted corporate bonds and longer-term maturities relative to the benchmark (from Exhibit 4), which generally offer higher yield than government bonds and short-term maturities. This decision contributed 11 bps to the excess return (from Exhibit 6).
  - ***Roll:*** The portfolio overweighted longer maturities (from Exhibit 4). Because of the shape of the yield curve, bonds with longer maturities generally sit on a flatter part of the yield curve, where the roll return is limited. The overweighting of the longer maturities reduced the portfolio roll return by 4 bps.
  - ***Shift:*** The portfolio overall duration of 8.17 is greater than the benchmark duration of 7.19 (from Exhibit 4), which, given the increase in yield of +1%, reduced the portfolio return by 89 bps.

Yield-Curve Decomposition

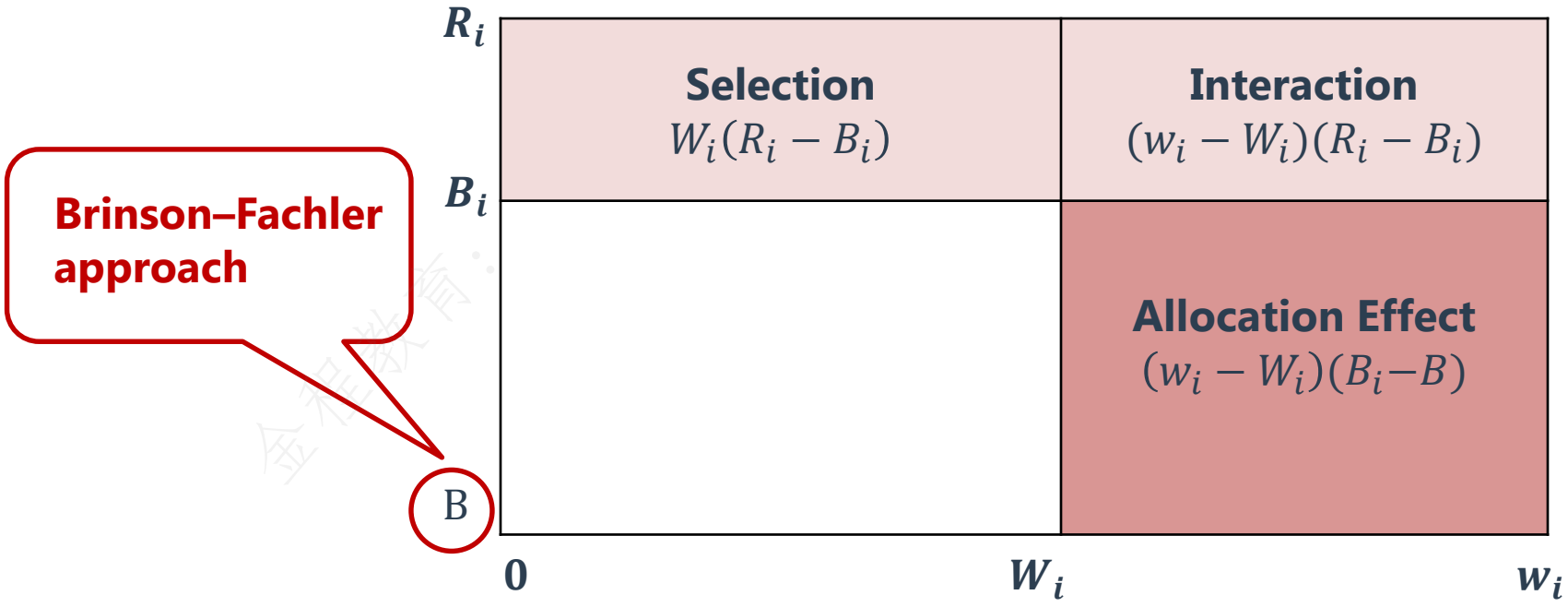
- ***Slope*:** The slope flattening caused the long-term yields to increase less than yields on shorter terms to maturity. The overweight at the long end of the curve contributed 39 bps to the excess return.
- ***Curvature*:** The reshaping of the yield curve resulted in a larger yield increase at the five-year maturity point. The manager underweighted that part of the yield curve. This decision contributed 53 bps to the excess return.
- ***Spread*:** The manager overweighted the corporate sector, which resulted in a 33 bps reduction in return because corporate spreads widened.
- ***Specific spread*:** Looking at the bond-specific spreads in Exhibit 6, the corporate 5% 30 June 2021 bond added 2 bps of selection return and the corporate (P) 6% 30 June 2031 bond added 15 bps of selection return. These decisions added a total of 17 bps to active return.
- ***Residual*:** A residual of –0.14% is unaccounted for because duration and convexity can only estimate the percentage price variation. It is not an accurate measure of the true price variation. The residual becomes more important during large yield moves, which is the case here, with a +1% yield shift.

Return Attribution Analysis at Multiple Levels

- The sponsor might also select multiple portfolio managers to manage against specific mandates within a given asset class.
  - **Macro attribution:** determine the impact of the **fund sponsor's** decisions.
    - ✓ "**Allocation**" measures the tactical asset allocation decision of the sponsor against its own strategic benchmark.
    - ✓ "**Selection**" measures the fund sponsor's manager selection decision.
  - **Micro attribution:** determine the impact of the **portfolio managers'** decisions on total fund performance.
    - ✓ "**Allocation**" measures the impact of sector allocation decisions within the manager's portfolio.
    - ✓ "**Selection**" measures the impact of selection decisions within each sector.

Return Attribution Analysis at Multiple Levels

- **Macro Attribution & Micro Attribution**
  - Allocation $=(w_i - W_i)(B_i - B)$
  - Selection + Interaction $=W_i(R_i - B_i)+(w_i - W_i)(R_i - B_i)$



Risk Attribution

- Risk attribution identifies the sources of risk in the investment process.
  - For absolute mandates, it identifies the sources of **portfolio volatility**.
  - For benchmark-relative mandates, it identifies the sources of **tracking risk**.
- Risk attribution should reflect the investment decision-making process.
- In all cases, risk attribution explains only where risk was introduced into the portfolio. It needs to be combined with return attribution to understand the full impact of those decisions.

Risk Attribution

Selecting the Appropriate Risk Attribution Approach		
	Type of Attribution Analysis	
Investment Decision-Making Process	**Relative (vs. Benchmark)**	**Absolute**
Bottom up	Position's marginal contribution to tracking risk	Position's marginal contribution to total risk
Top down	Attribute tracking risk to relative allocation and selection decisions	Factor's marginal contribution to total risk and specific risk
Factor based	Factor's marginal contribution to tracking risk and active specific risk	

Example: Risk Attribution

- Manager A is a market-neutral manager following a systematic investment approach, scoring each security on a proprietary set of risk factors. He seeks to maximize the portfolio score on the basis of the factor characteristics of individual securities. He has a hurdle rate of T-bills plus 5%. Which risk attribution approach is most appropriate to evaluate Manager A?
  A. Marginal contribution to total risk
  B. Marginal contribution to tracking risk
  C. Factor's marginal contributions to total risk and specific risk

- **Solution: A.**
  Manager A is a bottom-up manager with an absolute return target.
  B is incorrect because tracking risk is not relevant to an absolute return mandate.
  C is incorrect because, as a market-neutral manager, Manager A is not seeking to take different-from-market exposures.

Example: Risk Attribution

- Manager B has a strong fundamental process based on a comprehensive understanding of the business model and competitive advantages of each firm. He also uses sophisticated models to make explicit three-year forecasts of the growth of free cash flow to determine the attractiveness of each security's current valuation. His objective is to outperform the MSCI World ex-US Index by 200 bps. Which risk attribution approach is most appropriate to evaluate Manager B?

  A. Marginal contribution to total risk

  B. Marginal contribution to tracking risk

  C. Factor's marginal contributions to total risk and specific risk

- **Solution: B.**

  Manager B is a bottom-up manager with a relative return target.

  A and C are incorrect because they are best suited to absolute return mandates.

Example: Risk Attribution

- Manager C specializes in timing sector exposure and generally avoids idiosyncratic risks within sectors. Using technical analyses and econometric methodologies, she produces several types of forecasts. The manager uses this information to determine appropriate sector weights. The risk contribution from any single sector is limited to 30% of total portfolio risk. She hedges aggregate market risk and seeks to earn T-bills plus 300 bps.
- Which risk attribution approach is most appropriate to evaluate Manager C?

  A. Marginal contribution to total risk

  B. Marginal contribution to tracking risk

  C. Factor's marginal contributions to total risk and specific risk
- **Solution:**

  C is correct. Manager C is a top-down manager with an absolute return target. A factor-based attribution is best suited to evaluate the effectiveness of the manager's sector decisions and hedging of market risk.

Benchmarking Investments and Managers

- An **investment benchmark** is typically a collection of securities that represents the pool of assets available to the portfolio manager.
  - A benchmark should reflect the **investment process** and the **constraints** that govern the construction of the portfolio.
- Benchmarks help analysts measure the **effectiveness** of a manager's decisions to depart from benchmark weights.
- **Types of benchmarks**
  - **Asset-based benchmarks**
  - **Liability-based benchmarks**
    - ✓ Focus on the cash flows that the asset must generate.
    - ✓ Liability-based benchmarks are most often used when the assets are required to pay a specific future liability (e.g., as in a defined benefit pension plan).

Properties of a Valid Benchmark

- **Specified in advance**. The benchmark must be constructed prior to the evaluation period so that the manager is not judged against benchmarks created after the fact.
- **Appropriate**. The benchmark must be consistent with the manager's investment style or area of expertise.
- **Measurable**. It must be possible to measure the benchmark's return on a reasonably frequent and timely basis.
- **Unambiguous**. The individual securities and their weights in a benchmark should be clearly identifiable.
- **Reflective of current investment opinions**. The manager should be familiar with the securities that constitute the benchmark and their factor exposures.
- **Accountable**. The manager should accept ownership of the benchmark and its securities and be willing to be held accountable to the benchmark.
- **Investable**. It must be possible to replicate and hold the benchmark to earn its return (at least gross of expenses).

Seven Types of Asset-Based Benchmarks

- **Asset-based benchmarks** contain a collection of assets to compare against the portfolio's assets.
  - absolute (including target) return benchmarks,
  - broad market indexes,
  - style indexes,
  - factor-model-based benchmarks,
  - returns-based (Sharpe style analysis) benchmarks,
  - manager universes (peer groups), and
  - custom security-based (strategy) benchmarks.

Asset-Based Benchmarks

- An **absolute return benchmark** is a minimum target return that the manager is expected to beat.
  - **Advantage**
    - ✓ Simple and straightforward benchmark.
  - **Disadvantage**
    - ✓ Absolute return objective is not an investable benchmark.
  - e.g., 9% , the Euro Interbank Offered Rate + 4%

Asset-Based Benchmarks

- **Broad market indexes** are measures of broad asset class performance.
  - **Advantages**
    - ✓ Well recognized, easy to understand by clients, and widely available.
    - ✓ Unambiguous, generally investable, measurable, and may be specified in advance.
    - ✓ Appropriate to use if it reflects the current investment process of the manager.
  - **Disadvantage**
    - ✓ Manager's style may deviate from the style reflected in the index (e.g., it is not appropriate to use the S&P 500 for a small-capitalization U.S. growth stock manager).
    - ✓ Market indexes have also been more narrowly defined to represent investment styles within asset classes, resulting in style indexes.

Asset-Based Benchmarks

- **Style indexes**. An **investment style** is a natural grouping of investment disciplines that has some predictive power in explaining the future dispersion of returns across portfolios.
  - **Advantages**
    - ✓ They are widely available, widely understood by clients, and widely accepted.
    - ✓ If the index reflects the manager's style and it is investable, it is an appropriate benchmark.
  - **Disadvantages**
    - ✓ Some style indexes can contain weightings in certain securities and sectors that may be larger than considered prudent.
    - ✓ Differing definitions of investment style can produce quite different benchmark returns, making them inappropriate benchmarks.

Asset-Based Benchmarks

- **Factor-model-based benchmarks** can be constructed to more closely capture the investment decision-making process.
  - Building a factor model identifies the relative explanatory powers of each factor in the portfolio return.
  - $R_p = a_p + b_1F_1 + b_2F_2 + \cdots + b_kF_k + \epsilon_p$

    where:
    - ✓ R_p = the portfolio's periodic return
    - ✓ a_p = the "zero-factor" term, which is the expected portfolio return if all factor sensitivities are zero
    - ✓ b_k = the sensitivity of portfolio returns to the factor return
    - ✓ F_k = systematic factors responsible for asset returns
    - ✓ ϵ_p = residual return due to nonsystematic factors

Asset-Based Benchmarks

- **Factor-model-based benchmarks**
  - **Advantages**
    - ✓ It is useful in performance evaluation.
    - ✓ It provides managers and sponsors with insight into the manager's style by capturing factor exposures that affect an account's performance.
  - **Disadvantages**
    - ✓ Focusing on factor exposures is not intuitive to all managers or sponsors.
    - ✓ The data and modeling are not always available and may be expensive to obtain.
    - ✓ It may be ambiguous because different factor 'models can produce different outputs, leading to misspecification.

Asset-Based Benchmarks

- **Returns-based benchmarks** (Sharpe style analysis) are like factor-model-based benchmarks in that portfolio returns are related to a set of factors that explain portfolio returns.
  - With returns-based benchmarks, however, the factors are the returns for **various style indexes** (e.g., small-cap value, small-cap growth, large-cap value, and large-cap growth).
  - To create a returns-based benchmark using Sharpe style analysis, we use an optimization procedure to force the portfolio's sensitivities (analogous to the b_k's in factor-model-based benchmarks) to be **non-negative** and **sum to 1**.

Asset-Based Benchmarks

- **Returns-based benchmarks**
  - **Advantages**
    - ✓ Generally easy to use and intuitive.
    - ✓ Meets the criteria of a valid benchmark.
    - ✓ Useful where the only information available is account returns.
  - **Disadvantages**
    - ✓ The style indexes may not reflect what the manager owns or what the manager or client would be willing to own.
    - ✓ Enough monthly returns would be needed to establish a statistically reliable pattern of style exposures.
    - ✓ Will not work when applied to managers who change style.

Asset-Based Benchmarks

- A **manager universe**, or **manager peer group**, is a broad group of managers with similar investment disciplines.
  - Managers are typically expected to beat the universe's **median return**.
  - Some managers may have **tilts** or **constraints** that create an investment product very different from that of the median manager.
  - **Advantage**
    - ✓ It is measurable.
  - **Disadvantages**
    - ✓ Manager universes are subject to "survivor bias," as underperforming managers often go out of business and their performance results are then removed from the universe history.
    - ✓ Fund sponsors who choose to employ: manager universes must rely on the compiler's representations that the universe has been accurately compiled.
    - ✓ They cannot be identified or specified in advance, so it is not investable; thus, it's not an acceptable benchmark.

Asset-Based Benchmarks

- **Custom security-based benchmarks** are built to more precisely reflect the investment discipline of an investment manager.
  - Custom security-based benchmarks are also referred to as **strategy benchmarks** because they should reflect the manager's strategy.
  - These benchmarks are **costly** to calculate and maintain.
  - **Advantage**
    - ✓ Meets all the required benchmark properties and all the benchmark validity criteria.
    - ✓ Allows continual monitoring of investment processes.
    - ✓ Allows fund sponsors to effectively allocate risk across investment management teams.
  - **Disadvantages**
    - ✓ It can be expensive to construct and maintain.
    - ✓ A lack of transparency by the manager (e.g., hedge funds) can make it impossible to construct such a benchmark.

Evaluating Benchmark Quality

- The portfolio return (P) is a result of the market index return (M), a style return (S), and the active management return (A).

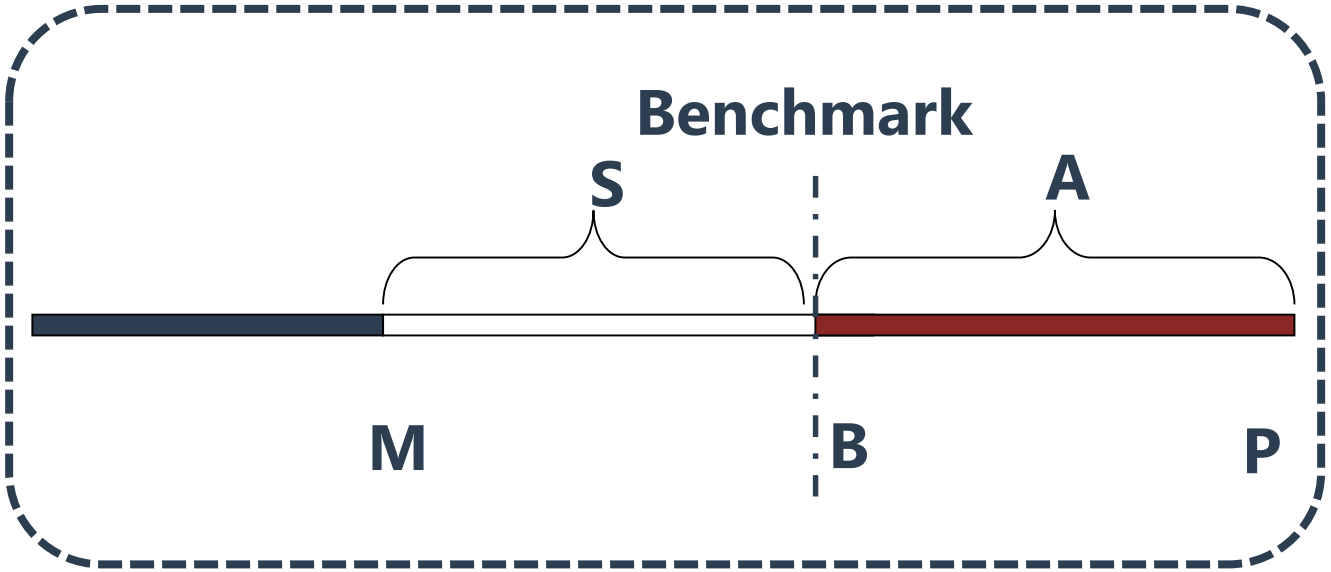
$$P = M + S + A$$

where:

- P: a portfolio's return
- B: appropriate benchmark return
- M: market index return
- S: style return
- A: active management return
- E = (P – M): difference between the portfolio and the broad market index

- If the manager's portfolio is **a broad market index** where S = 0 and A = 0, then the portfolio earns the broad market return: P = M.
- If the benchmark is a broad market index, then S is assumed to be zero and the prediction is that the manager earns the market return and a return to active management: P = M + A.

Evaluating Benchmark Quality



- A good benchmark should not reflect these systematic biases, where the correlation between A and S should not be statistically different from zero. $\boldsymbol{\rho(A,S)=0}$
- A good benchmark will have a statistically significant positive correlation coefficient between S and E. $\boldsymbol{\rho(S,E)>0}$
  - We define the difference between the portfolio and the broad market index as E = (P – M).

Example: Decomposition of Portfolio Return

- A US large-cap value portfolio run by Anderson Investment Management returned 18.9% during the first three quarters of 2019. During the same time period, a US large-cap value index had a return of 21.7% and a broad US equity index returned 25.2%.
  A. Calculate the return due to style.
  B. Calculate the return due to active management.
  C. Using your answers to A and B, discuss Anderson's performance relative to the benchmark and relative to the market.

Example: Decomposition of Portfolio Return

- **Solution to:**
  A. The return due to style is the difference between the benchmark and the market index, or S = (B − M) = (21.7% − 25.2%) = −3.5%.
  B. The return due to active management is the difference between the portfolio and the benchmark, or A = (P − B) = (18.9% − 21.7%) = −2.8%.
  C. Anderson's underperformance relative to the broad US equity index is partly a function of style and partly a function of the manager's weak performance within the style. Given that the US large-cap value index underperformed the US market index by 3.5%, we can infer that large-cap value was out of favor during the period measured. Provided the US large-cap value index is an appropriate benchmark for Anderson, the manager's underperformance bears further investigation. The client would want to understand the specific drivers of the underperformance and relate those decisions to the manager's stated investment process.

Benchmarking Alternative Investments

- Alternative investments are difficult to benchmark because they are typically less liquid, have fewer available market benchmarks, and often lack transparency.
  - Benchmarking Hedge Fund Investments
  - Benchmarking Real Estate Investments
  - Benchmarking Private Equity
  - Benchmarking Commodity Investments
  - Benchmarking Managed Derivatives
  - Benchmarking Distressed Securities

Benchmarking Hedge Fund Investments

- Hedge funds may have an unlimited investment universe, vary substantially from one to another, and can vary their asset allocations over time.
  - A manager's use of style, leverage, short positions, and derivatives may change over time.
  - Hedge funds also typically lack transparency, are difficult to monitor, and are often illiquid.
- Hedge fund peer universes are subject to a number of **limitations**:
  - The risk and return characteristics of a strategy peer group is **unlikely** to be representative of the approach taken by a single fund.
  - Hedge fund peer groups suffer from **survivorship** and **backfill bias**.
  - Hedge fund performance data are often **self-reported** and typically not confirmed by the index provider

Benchmarking Real Estate Investments

- The following are some **limitations** of the available real estate benchmarks:
  - The benchmarks are based on a subset of the real estate opportunity set and, therefore, are not fully representative of the asset class.
  - Index performance is likely to be highly correlated with the returns of the largest fund data contributors.
  - Benchmark returns are based on manager-reported performance and may be inherently biased.
  - Benchmarks weighted by fund or asset value may place a disproportionate emphasis on the most expensive cities and asset types.
  - Valuations of the underlying properties are typically based on appraisals because there are few transactions to measure.
  - Some benchmark returns are unlevered, whereas others contain varying degrees of leverage based on the structure used by the investor that contributed the data.
  - Real estate indexes do not reflect the high transaction costs, limited transparency, and lack of liquidity that drive performance for actual real estate investments.

Benchmarking Private Equity

- There are several **limitations** to be aware of when comparing returns among managers:
  - The valuation methodology used by the managers may differ.
  - A fund's IRR can be meaningfully influenced by an early loss or an early win in the portfolio.
  - The data are from a specific point in time, and the companies in a fund can be at different stages of development.

Benchmarking Commodity Investments

- Commodity benchmarks tend to use indexes based on the performance of **futures-based** commodity investments.
- Benchmarking of commodity investments presents similar **challenges** to other alternatives, including:
  - the use of derivatives to represent actual commodity assets,
  - varying degrees of leverage among funds, and
  - the discretionary weighting of exposures within the index.

Benchmarking Managed Derivatives

- Because market indexes do **not** exist for managed derivatives, the benchmarks are typically specific to a single investment strategy.
- Other derivative benchmarks are based on peer groups.
  - These indexes suffer from the known limitations of peer group–based benchmarks, including **stale pricing** and **survivorship** and **backfill bias.**

Benchmarking Distressed Securities

- Distressed securities are illiquid and almost non-marketable at the time of purchase, making it very difficult to find suitable benchmarks.
- Typically, it takes a relatively long time for investment strategies of distressed Securities to play out; thus, valuing the holdings may be a challenge.
  - It is difficult to estimate the true market values of distressed securities, and **stale pricing** is almost inevitable.
- One possible strategy is to use market indexes, such as the Barclay Distressed Securities Index.
  - Because this index is constructed from multiple strategies, however, it is difficult to discern whether the index is suitable for a given investment approach.
  - In addition, because the valuations for the member funds are calculated at random intervals, it doesn't necessarily correct for the valuation issues noted previously.

Importance of Choosing the Correct Benchmark

- The phrase garbage in, garbage out is appropriate to use regarding the impact of benchmark misspecification on attribution and appraisal analysis.
- Benchmark misspecification creates subsequent incorrect performance measurement and invalidates the attribution and appraisal analyses.
- Sometimes, benchmarks are chosen for the wrong reasons. Underperforming managers have been known to change benchmarks to improve their measured excess return, which is both inappropriate and unethical.
- Using a broad market index typically misses the manager's style.

Performance Appraisal

- The **Sharpe ratio** measures the additional return for bearing risk above the risk-free rate, stated per unit of return volatility. In performance appraisal, this additional return is often referred to as **excess return**.

$$S_A = \frac{\bar{R}_A - \bar{r}_f}{\hat{\sigma}_A}$$

  - One **weakness** of the Sharpe ratio is that the use of standard deviation as a measure of risk assumes investors are indifferent between upside and downside volatility.
- The **Treynor ratio** measures the **excess return per unit of systematic risk**.

$$T_A = \frac{\bar{R}_A - \bar{r}_f}{\hat{\beta}_A}$$

  - Because of its reliance on beta (only considers **systematic risk**), the Treynor ratio shows how a fund has performed in relation not to its own volatility but to the volatility it would bring to a well-diversified portfolio.

Performance Appraisal

- The **information ratio (IR)** is a simple measure that allows the evaluator to assess performance relative to the benchmark, scaled by risk.

$$\mathrm{IR} = \frac{\mathrm{E}(\mathrm{r_P}) - \mathrm{E}(\mathrm{r_B})}{\sigma(\mathrm{r_P} - \mathrm{r_B})}$$

  - The implicit assumption is that the chosen benchmark is well matched to the risk of the investment strategy.
    - ✓ The information ratio (IR) is used to measure a portfolio's performance against the benchmark but accounting for differences in risk.

Performance Appraisal

- The **appraisal ratio (AR)** is a returns-based measure. It is the annualized alpha (**Jensen's alpha**) divided by the annualized residual risk (**unsystematic risk**). The appraisal ratio measures the reward of active management relative to the risk of active management.

$$\mathrm{AR} = \frac{\alpha}{\sigma_\varepsilon}$$

Where,

σ_ε equals the standard deviation of ε_t.

- The alpha and the residual risk are computed from a **factor regression**.
- The appraisal ratio is also referred to as the **Treynor–Black ratio** or the **Treynor–Black appraisal ratio**.

Performance Appraisal

- The **Sortino ratio** is a modification of the Sharpe ratio that penalizes only those returns that are lower than a user-specified return.

$$\mathrm{SR_D} = \frac{\mathrm{E}(r_p) - r_T}{\sigma_D} \qquad \widehat{\mathrm{SR}}_\mathrm{D} = \frac{\bar{r}_p - \bar{r}_T}{\hat{\sigma}_D} \qquad \sigma_\mathrm{D} = \left[\frac{\sum_{\mathrm{t}=1}^{\mathrm{N}} \min(r_t - r_T, 0)^2}{N}\right]^{1/2}$$

where r_T is the minimum acceptable return (MAR), which is sometimes referred to as a target rate of return.

- The Sortino ratio uses a measure of **downside risk** known as target semi-standard deviation or target semideviation.
- The Sortino ratio penalizes managers only for **"harmful" volatility** and is a measure of **return per unit of downside risk**.
- Sortino ratio offers the ability to accurately assess performance when return distributions are **not symmetrical**.
- Essentially, the Sortino ratio **penalizes** a manager when portfolio return is lower than the MAR; it is most relevant when one of the investor's primary objectives is capital preservation.
- **Cross-sectional comparisons** of Sortino ratios are difficult to make applicable to every investor, because the MAR is investor-specific.

Example: Sortino ratio

- Portfolio B delivered 10.0% annual returns on average over the past 60 months. Its average annual volatility as measured by standard deviation was 14.0%, and its downside volatility as measured by target semi-standard deviation was 8.0%. Assuming the target rate of return is 3.0% per year, the Sortino ratio of portfolio B is closest to:
  A. 0.66.
  B. 0.77.
  C. 0.88.

- **Solution:**
  C is correct.

$$\widehat{\mathrm{SR}}_{\mathrm{D}} = \frac{\overline{r}_p - \overline{r}_T}{\hat{\sigma}_D} = \frac{0.10 - 0.03}{0.08} = 0.88$$

Example: Sortino ratio

- Why might a practitioner use the Sortino ratio, rather than the Sharpe ratio, to indicate performance?
  A. He is measuring option writing.
  B. The return distributions are not symmetrical.
  C. The investor's primary objective is capital preservation.
  D. All of the above

- **Solution:**
  D is correct, because the Sortino ratio is more relevant when return distributions are not symmetrical, as with option writing. The Sortino ratio is also preferable when one of the primary objectives is capital preservation.

Example: AR

- Portfolio Y delivered an average annualized return of 9.0% over the past 60 months. The annualized standard deviation over this same time period was 20.0%. The market index returned 8.0% per year on average over the same time period, with an annualized standard deviation of 12.0%. Portfolio Y has an estimated beta of 1.40 versus the market index. Assuming the risk-free rate is 3.0% per year, the appraisal ratio is closest to:

  A. –0.8492.

  B. –0.0922.

  C. –0.0481.

Example: Performance Appraisal Measures

- **Solution: B.**

  B is correct. Jensen's alpha is –1.0%: α_p = 9.0% – [3.0% + 1.40(8.0% – 3.0%)] = –1.0% = –0.01. Non-systematic risk is 0.011776: ${\sigma_{\varepsilon_p}}^2 = 0.20^2 - 1.40^2(0.12^2) = 0.011776$. The appraisal ratio is approximately –0.0922:

$$\widehat{\mathrm{AR}} = \frac{-0.01}{\sqrt{0.011776}} = -0.0922$$

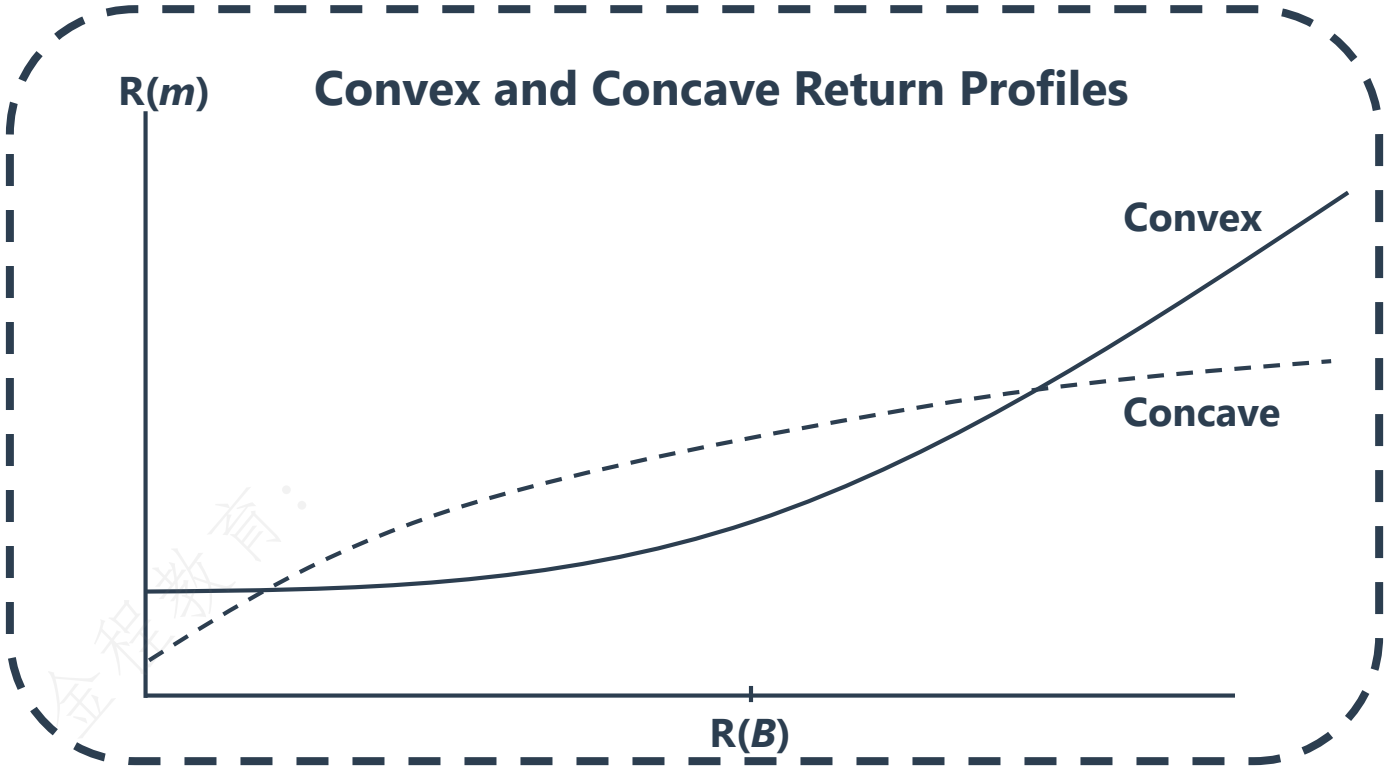
Performance Appraisal

- **Capture ratios**
  - The upside/downside capture, or simply the **capture ratio (CR)**,

    CR(mB,t) = UC(m,B,t)/DC(m,B,t)
  - The **upside capture ratio** UC(m,B,t) = R(m,t)/R(B,t) if R(B,t) ≥ 0
    - ✓ UC>100%, outperform the market.
  - The **downside capture ratio**(DC), DC(m,B,t) = R(m,t)/R(B,t) if R(B,t) < 0
    - ✓ DC<100%, outperform the market.

  where
    - ✓ R(m,t) = return of manager *m* for time *t*
    - ✓ R(B,t) = return of benchmark *B* for time *t*
  - It **measures the asymmetry of return** (e.g. convexity, gamma).
    - ✓ A **capture ratio greater than 1** indicates **positive asymmetry**, or a **convex** return profile;
    - ✓ A **capture ratio less than 1** indicates **negative asymmetry**, or a **concave** return profile.

Performance Appraisal



Performance Appraisal

- **Drawdown** is measured as the cumulative peak-to-trough loss during a continuous period.
- **Drawdown duration is** the total time from the start of the drawdown until the cumulative drawdown recovers to zero, which can be segmented into the drawdown phase (start to trough) and the recovery phase (trough-to-zero cumulative return).

$$Maximum\ DD(m,t) = \min\left(\frac{V(m,t) - V(m,t*)}{V(m,t*)}, 0\right)$$

where

V(m,t) = portfolio value of manager *m* at time *t*

V(m,t*) = peak portfolio value of manager *m*

$t > t^*$

Example: Drawdown

Month	R(*m*)	Cumulative R(*m*)	Drawdown	Cumulative Drawdown	Comments
January 2011	2.37%	2.37%		0.00%	
February 2011	3.43%	5.88%		0.00%	
March 2011	0.04%	5.92%		0.00%	
April 2011	2.96%	9.06%		0.00%	
May 2011	–1.13%	7.83%	–1.13%	–1.13%	Drawdown begins
June 2011	–1.67%	6.03%	–1.67%	–2.78%	
July 2011	–2.03%	3.87%	–2.03%	–4.75%	
August 2011	–5.43%	–1.77%	–5.43%	–9.93%	
September 2011	–7.03%	–8.67%	–7.03%	–16.26%	Maximum drawdown
October 2011	10.93%	1.31%		–7.11%	Recovery begins
November 2011	–0.22%	1.09%	–0.22%	–7.31%	
December 2011	1.02%	2.12%		–6.36%	
January 2012	4.48%	6.69%		–2.17%	
February 2012	4.32%	11.30%		0.00%	Recovery begins

Example: Drawdown

- Consider the return on the S&P 500 Index from January 2011 to February 2012. The drawdown is 0% until May 2011, when the return is –1.13% and the drawdown continues to grow, reaching a maximum of –16.26% in September 2011. The strong returns from October 2011 to February 2012 reverse the drawdown. The total duration of the drawdown was 10 months, with a 5-month recovery period.

Reading 27

Investment Manager Selection

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Framework

1. Manager Selection Process
2. Type I and Type II Errors in Manager Selection
3. Quantitative Elements of Manager Search and Selection
    - Style Analysis
    - Capture Ratios and Drawdowns
4. Qualitative Elements of Manager Due Diligence
    - Investment Philosophy
    - Investment Personnel
    - Investment Decision-Making Process
    - Operational Due Diligence

Manager Selection Process

- **Due diligence** is the analysis and investigation in support of an investment decision, action, or recommendation.
- The manager search and selection process has **three** broad components:
  - Manager Universe
  - Quantitative Analysis
  - Qualitative Analysis

Manager Selection Process

- **Manager Universe**
  - The manager selection process begins by **defining the universe of feasible managers**, those managers that potentially satisfy the identified portfolio need.
  - The manager universe consists of only those managers who are **suitable** for the portfolio in terms of the objectives and constraints of the **IPS**, invest in the relevant **style** (e.g., value, growth, mixed) desired by the client, and will manage the portfolio with the appropriate balance between **active** versus **passive** approaches.
  - The IPS and the reason for the manager search largely determine the universe of managers considered and the benchmark against which they are compared.
    - ✓ The benchmark can be determined using one or more of: third-party categorization, returns-based style analysis, holdings-based style analysis, and manager experience.

Manager Selection Process

- **Hypothesis**
  - H_0: the manager adds no value.
  - H_a: the manager adds positive value.
- **Type I**: Hiring or retaining a manager who subsequently underperforms expectations. (error of commission-explicit cost, easily measured)
- **Type II**: Not hiring or firing a manager who subsequently outperforms, or performs in line with, expectations. (error of omission-opportunity cost, more difficult to be explained)

Type I and Type II Errors

		Realization	
		Below expectations (no skill)	At or above expectations (skill)
Decision	Hire/Retain	Type I	Correct
	Not Hire/Fire	Correct	Type II

Manager Selection Process

- The cost of errors is driven by the size, shape, mean, and dispersion of the return distributions of the skilled and unskilled managers within the universe.
  - The **smaller the difference** in sample size and distribution mean and the wider the dispersion of the distributions, the **smaller the expected cost** of the Type I or Type II error.
  - The extent to which markets are mean-reverting also has a bearing on the cost of Type I and Type II errors.
    - ✓ If performance is mean reverting, firing a poor performer (or hiring a strong performer) only to see a reversion in performance results is a Type I error.
    - ✓ A Type II error would be not trimming strong performers and avoiding hiring managers with weaker short-term track records, which can be costly.

Example: Type I and Type II Errors

- The difference in expected cost between Type I and Type II errors is most likely:
  A. higher the smaller the perceived difference between the distribution of skilled and unskilled managers.
  B. lower the smaller the perceived difference between the distribution of skilled and unskilled managers.
  C. the expected cost difference of Type I and Type II error is zero, because they reflect different aspects of the same issue.

Example: Type I and Type II Errors

- **Solution: B.**

  B is correct. The less distinct the distribution of skilled managers from unskilled managers, the lower the opportunity cost of retaining and cost of hiring an unskilled manager. That is, the smaller the perceived difference between the distribution of skilled and unskilled managers, the lower the cost and incentive to fire a manager.

Quantitative Elements of Manager Search and Selection

- **Style Analysis**
  - Returns-based style analysis (RBSA)
  - Holdings-based style analysis (HBSA)
- **Capture Ratios and Drawdowns in Manager Evaluation**
  - upside capture ratio (UC)
  - downside capture ratio (DC)
  - capture ratio (CR)
  - maximum drawdown
  - drawdown duration

Approaches to Manager Analysis

- **Style Analysis**
  - A manager's self-reported risk exposures are the starting point in style analysis.
  - The results of the **returns-based style analysis** (RBSA) and the **holdings-based style analysis** (HBSA) should be consistent with the manager's philosophy and the investment process.
  - Style analysis is most useful with strategies that hold publicly-traded securities where pricing is frequent.
  - To be useful, style analysis must be:
    - ✓ **Meaningful:** The risks reported must represent the important sources of performance return and risk.
    - ✓ **Accurate:** The reported values must reflect the manager's actual risk exposures.
    - ✓ **Consistent:** The methodology must allow for comparison over time and across multiple managers.
    - ✓ **Timely:** The report must be available in a timely manner so that it is useful for making informed investment decisions.

RBSA & HBSA

Holdings-based style analysis		
Portfolio Characteristics for GF Active Equity Strategy Based on **Current-Period Data**		
	Active Equity	**Benchmark**
Number of stocks	50	1,000
Market value	$180 billion	$4,400 billion
Weighted average market capitalization	$4.0 billion	$4.1 billion
Dividend yield	3.00%	2.00%
Price/Earnings	8×	12×

Returns-based style analysis			
Return Correlations between GF's Active Equity Approach and Benchmarks Based on 36 Months of **Historical Data**			
	Value	**Blend**	**Growth**
Coefficient of determination	0.39	0.45	0.65

Approaches to Manager Analysis

- **Returns-based style analysis (RBSA)**
  - Returns-based style analysis is a **top-down approach** that involves estimating the risk exposures from an actual return series for a given period.
  - Although RBSA adds the additional analytical step of estimating the risk factors, the analysis is straightforward and typically does **not** require a large amount of additional, or difficult to acquire, data.
  - It can be estimated even for complicated strategies and is comparable across managers and through time.
  - The **disadvantage** is that RBSA is an **imprecise** tool, attributing performance to a **static portfolio** during the period that might not reflect the current or future portfolio exposures.
  - Furthermore, the portfolio being analyzed might **not** reflect the current or future portfolio exposures.
    - ✓ If the portfolio contains illiquid securities, **stale prices** may understate the risk exposure of the strategy.

Approaches to Manager Analysis

- **Holdings-based style analysis (HBSA)**
  - Holdings-based style analysis is a **bottom-up approach** that estimates the risk exposures from the actual securities held in the portfolio at a point in time.
  - HBSA allows for the estimation of **current risk factors** and should identify all important drivers of return and risk factors, be comparable across managers and through time, and provide an **accurate** view of the manager's risk exposures.
  - The **disadvantages** are the additional computational effort, dependence on the **degree of transparency** provided by the manager, and the possibility that accuracy may be compromised by stale pricing and window dressing.
  - HBSA uses a point in time analysis format that may **not** be useful in projecting into the future or if the portfolio has high turnover.

Qualitative Elements of Manager Due Diligence

- **The qualitative analysis consists of**
  - **Investment due diligence.** Evaluates the manager's investment process.
    - ✓ Investment Philosophy
    - ✓ Investment Personnel
    - ✓ Investment Decision-Making Process
      - ◆ Signal Creation (Idea Generation)
      - ◆ Signal Capture (Idea Implementation)
      - ◆ Portfolio Construction
      - ◆ Monitoring the Portfolio
  - **Operational due diligence.** Evaluates the manager's infrastructure and firm.
    - ✓ Firm
    - ✓ Investment Vehicle
    - ✓ Evaluation of the Investment's Terms

Investment Philosophy

- The investment philosophy is the **foundation** of the investment process.
- The philosophy outlines the set of **assumptions** about the factors that drive performance and the manager's beliefs about their ability to successfully exploit these sources of return.
  - The investment manager should have a **clear and concise** investment philosophy.
  - The investment process has to be **consistent and appropriate** for the philosophy, and the investment personnel need to possess sufficient expertise and experience to effectively execute the investment process.

Investment Philosophy

- **Passive strategies** seek to capture return through exposure to systematic risk premiums, such as equity risk, duration risk, or credit risk.
- In contrast, **active strategies** take the position that markets are inefficient.
  - **Behavioral inefficiencies** are mispricings caused by other investors and their behavioral biases (e.g., trend-following). The mispricings are very short-term in nature.
  - **Structural inefficiencies** occur because of laws and regulations, which can make them long-term in nature.
  - Capacity to achieve alpha
    - ✓ The **level of assets** the strategy can absorb without a dilution of returns;
    - ✓ **Repeatability and sustainability**: number of securities available;
    - ✓ **Liquidity**: low transaction cost (transact in a timely manner or near market price.

Example: Investment Philosophy

- Generally speaking, inefficiencies can be categorized as:
  A. large and small.
  B. internal and external.
  C. structural and behavioral.
- **Solution: C.**

  C is correct. Behavioral inefficiencies are created by the actions of other participants in the market. These inefficiencies are temporary, lasting long enough for the manager to identify and exploit them before the market price and perceived intrinsic value converge. Structural inefficiencies are created by external or internal rules and regulations. These inefficiencies can be long lived and assume a continuation of the rules and regulations rather than a convergence.

Investment Personnel

- An investment process can only be as good as the people who create and implement it, and even the best process can be compromised by poor execution by the people involved.
  - Does the investment team have **sufficient expertise** and **experience** to effectively execute the investment process?
  - Does the investment team have **sufficient depth** to effectively execute the investment process?
  - What is the level of **key person risk**?
  - What kinds of **agreements** (e.g., non-compete) and **incentives** (ownership, bonus, pay) exist to retain and attract key employees to join and stay at the firm?
  - What has been the **turnover** of firm personnel?

Investment Decision-Making Process

- **Signal Creation (Idea Generation)**
  - An investment signal is a **data point** or **fact** that can be observed early enough to implement as an investment position.
    - ✓ **Unique**: To effectively exploit inefficiencies, investment strategies must utilize unique information to have an informational advantage over other market participants.
    - ✓ **Timely**: The unique information must be obtained and used on a very timely basis as it is frequently the case that the window of opportunity to exploit is very short.
    - ✓ **Interpreted differently**: The investment manager must have superior cognitive or interpretive skills with regards to utilizing the information.

Investment Decision-Making Process

- **Signal Capture (Idea Implementation)**
  - Here the investment idea is transformed into an investment position (i.e., signal capture).
  - Two **key concerns** include the
    - ✓ repeatability of process and its congruence with the investment philosophy;
    - ✓ determination and approval of the investment position.

Investment Decision-Making Process

- **Portfolio Construction**
  - Capture the manager's risk management methodology.
  - Portfolio construction is consistent with the investment philosophy and process as well as the expertise of the investment personnel.
  - Allocation of long and short positions
  - Assets under management (AUM) will likely increase over time, therefore, the underlying positions may need to be adjusted (e.g., liquidity constraints) to allow for greater AUM.
  - **Stop losses**.
    - ✓ **Hard stop losses**: positions are automatically sold when the loss threshold is reached.
    - ✓ **Soft stop losses**: positions are evaluated when the loss threshold is reached.
  - With liquidity, it should be determined whether the manager is a net supplier or demander of liquidity.

Investment Decision-Making Process

- **Monitoring the Portfolio**
  - The investment decision-making process is a **feedback loop** that consists of ongoing monitoring of the portfolio in light of new information and analysis.
  - This monitoring includes an assessment of both external and internal considerations.
    - ✓ **External considerations** include the economic and financial market environments.
    - ✓ **Internal considerations** include the portfolio's performance, risk profile, and construction.

Operational Due Diligence

- Performance appraisal assumes that reported returns are accurate and fully reflect the manager's risk profile. Unfortunately, as we have seen, this assumption is not always true.
- Operational due diligence analyzes the integrity of the business and seeks to understand and evaluate these risks by examining and evaluating the firm's policies and procedures.
  - Firm
  - Investment Vehicle
  - Evaluation of the Investment's Terms

Firm

- An investment management firm must operate as a successful business to ensure sustainability.
- A firm that is independently owned may have greater autonomy and flexibility than a firm owned by a larger organization, but it may have a higher cost structure and lack financial support during market events, raising potential business risks.
- Last, and by no means least important, are legal and compliance issues. It is critical that the firm's interests are aligned with those of the investor.

Investment Vehicle

- There are two broad options for implementing investment strategies: **individual separate accounts** and **pooled (or commingled) vehicles**.
  - **Separate accounts** offer additional control, customization, tax efficiency, reporting, and transparency advantages, but these come at a higher cost.
  - In a **pooled or commingled vehicle**, the money from multiple investors is held as a single portfolio and managed without potential customization for any investor.
    - ✓ Such vehicles include open-end funds, closed-end funds, exchange-traded funds, exchange-traded notes, and hedge funds.

Investment Vehicle

- The **advantages of SMA** vehicles include the following:
  - **Ownership**: In an SMA, the investor owns the individual securities directly.
  - **Customization**: SMAs allow the investor to potentially express individual constraints or preferences within the portfolio.
  - **Tax efficiency**: SMAs offer potentially improved tax efficiency because the investor pays taxes only on the capital gains realized and allows the implementation of tax-efficient investing and trading strategies.
  - **Transparency**: SMAs offer real-time, position-level detail to the investor, providing complete transparency and accurate attribution to the investor.

Investment Vehicle

- If the SMA is customized, additional investment due diligence may be required to account for differences in security selection or portfolio construction. **Disadvantages** include:
  - **Cost**: Separate accounts represent an additional operational burden on the manager, which translates into potentially higher costs for the investor.
  - **Tracking risk**: Customization of the strategy creates tracking risk relative to the benchmark, which can confuse attribution because performance will reflect investor constraints rather than manager decisions.
  - **Investor behavior**: Transparency, combined with control and customization, allows for potential micromanagement by the investor—that is, the investor attempting to manage the portfolio.

Example: Pooled Investments and SMA

- Which of the following are advantages of separately managed accounts compared with pooled investments?
  A. Typically lower cost
  B. Potential management of the portfolio by the investor
  C. Ability to take close account of individual client constraints or preferences
- **Solution:**

  C is correct. With SMAs, the investor owns the individual securities directly and can potentially express individual constraints or preferences within the portfolio. In particular, SMAs offer potentially improved tax efficiency because the investor pays taxes only on the capital gains realized and allows the implementation of tax-efficient investing and trading strategies.

Evaluation of the Investment's Terms

- The prospectus, private placement memorandum, and/or limited partnership agreement are, in essence, the contract between the investor and the manager, outlining each party's rights and responsibilities. This section focuses on **liquidity terms** and **fees**.

Liquidity terms

➢ Liquidity

- **Liquidity** is defined as the timeliness with which a security or asset can be sold at or near the current price.
  - ✓ The most liquid vehicles are **closed-end funds and ETFs**.
  - ✓ **Limited partnerships**
  - ✓ **Private equity and venture capital funds** provide the least liquidity.
  - ✓ An SMA's liquidity will depend on the liquidity of the securities held.
- Limited liquidity **reduce the investor's flexibility** to adjust portfolio allocations in light of changing market conditions or investor circumstances.
- On the other hand, limited liquidity allows the funds to take long-term views and hold less liquid securities with **reduced risk of having to divest assets at inopportune times in response to redemption requests**.

Fees Structure

- **Fee structures (Management Fees, MF)** can influence which managers will be willing to accept a particular investment mandate.
  - **Assets under management fees**, also called *ad valorem fees* (from the Latin for "according to value"), result from applying stated percentage rates to assets under management.
  - **Performance-based fees (incentive fees, IF)** are determined by portfolio returns and are designed to reward managers with a share of return for their skill in creating value.

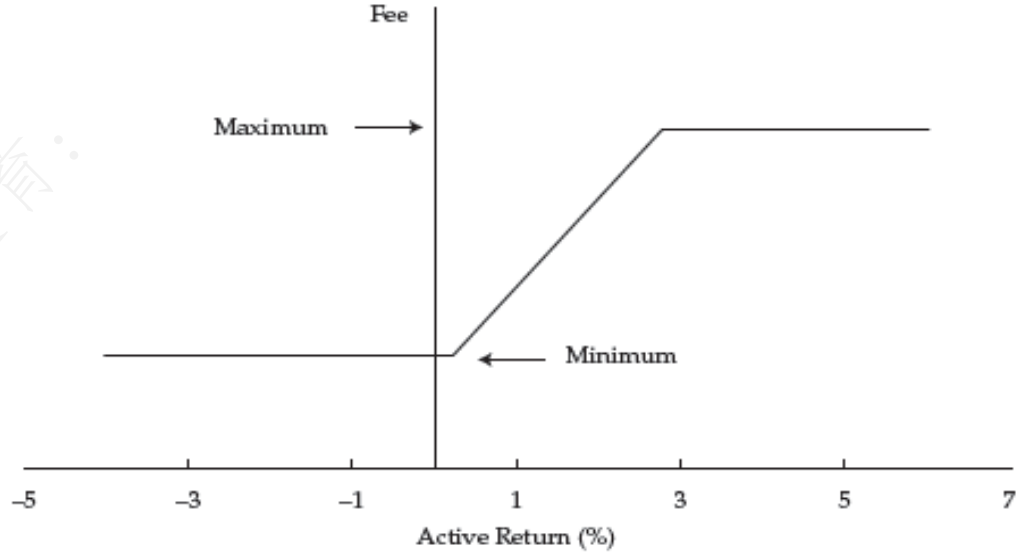
Fees Structure

- There are three **basic forms** of performance-based fees:
  - A **symmetrical** structure in which the manager is fully exposed to both the downside and upside
    - ✓ **Computed fee = Base + Sharing of performance**
  - A bonus structure in which the manager is not fully exposed to the downside but is fully exposed to the upside
    - ✓ **Computed fee = max (Base, Base plus sharing of positive performance)**
  - A bonus structure in which the manager is not fully exposed to either the downside or the upside
    - ✓ **Computed fee = max (Base, Base plus sharing of performance, to a limit)**
- Fee structures must be designed carefully to avoid favoring one party over the other.
- The **preference is for more-linear compensation** to reduce the incentives to change the portfolio's risk profile at inflection points

Call Option

- **Bonus-style fees** are the close equivalent of a manager's **call option** on a share of active return, for which the base fee is the strike price.
  - The graph illustrates three fee components: a 25 bps base fee, plus a long call option on active return with a strike price equal to the minimum (base) fee, minus another (less valuable) call option with a strike price equal to the maximum fee.

Payoff Line of Sample Performance-Based Fee Schedule



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Sample Performance-Based Fee Schedule

- A simple performance-based fee, specifies a base fee below which the computed fee can never fall. In this case, the manager is protected against sharing for performance below 25 bps. To make the result symmetrical around the commonplace 50 bps fee, the manager does not share in active performance beyond 2.75%.

Panel A. Sample Fee Structure

Standard fee	0.50%
Base fee	0.25%
Sharing*	20%
Breakeven active return	1.50%
Maximum annual fee	0.75%

Panel B. Numerical Examples for Annual Periods

	Active Return				
	≤ 0.25%	**1.00%**	**1.50%**	**2.00%**	**≥ 2.75%**
Billed fee	0.25%	0.40%	0.50%	0.60%	0.75%
Net active return	≤ 0.00%	0.60%	1.00%	1.40%	≥ 2.00%

* On active return, beyond base fee.

Sample Performance-Based Fee Schedule

- Based on the details in Panel A and the summary calculations in Panel B, the fee is a bonus with limited upside (maximum billed fee) and downside (minimum billed fee) exposures. There is symmetry within the active return range of 0.25% and 2.75% and centered around a breakeven active return of 1.50%. In calculating the breakeven return, we have the following:

  (1.50% — 0.25%) × 20% = 0.25% performance fee
- Adding the performance fee to the base fee of 0.25% results in a total billed fee of 0.50%, which is the same as the standard fee of 0.50%.
- At an active return of 0.25% or less, the performance fee is zero (the non-negativity constraint frequently encountered in practice prevents the performance fee from being negative).
- In that case, the billed fee is simply the base fee of 0.25%. At an active return of 2.75% or more, the performance fee is maximized at 0.50%, and so the billed fee is a maximum of 0.75%.

It’s not the end but just beginning.

By training your thoughts to concentrate on the bright side of things, you are more likely to have the incentive to follow through on your goals. You are less likely to be held back by negative ideas that might limit your performance.

试着训练自己的思想朝好的一面看，这样你就会汲取实现目标的动力，而不会因为消极沉沦停滞不前。

问题反馈

- 如果您认为金程课程 **讲义/题库/视频** 或其他资料中存在错误，欢迎您告诉我们，所有提交的内容我们会在最快时间内核查并给与答复。
- **如何告诉我们？**
  - 将您发现的问题通过电子邮件告知我们，具体的内容包含：
    - ✓ 您的姓名或网校账号
    - ✓ 所在班级（eg.1912CFA一级长线无忧班）
    - ✓ 问题所在科目（若未知科目，请提供章节、知识点）和页码
    - ✓ 您对问题的详细描述和您的见解
  - 请发送电子邮件至：academic.support@gfedu.net
- **非常感谢您对金程教育的支持，您的每一次反馈都是我们成长的动力。后续我们也将开通其他问题反馈渠道（如微信等）。**