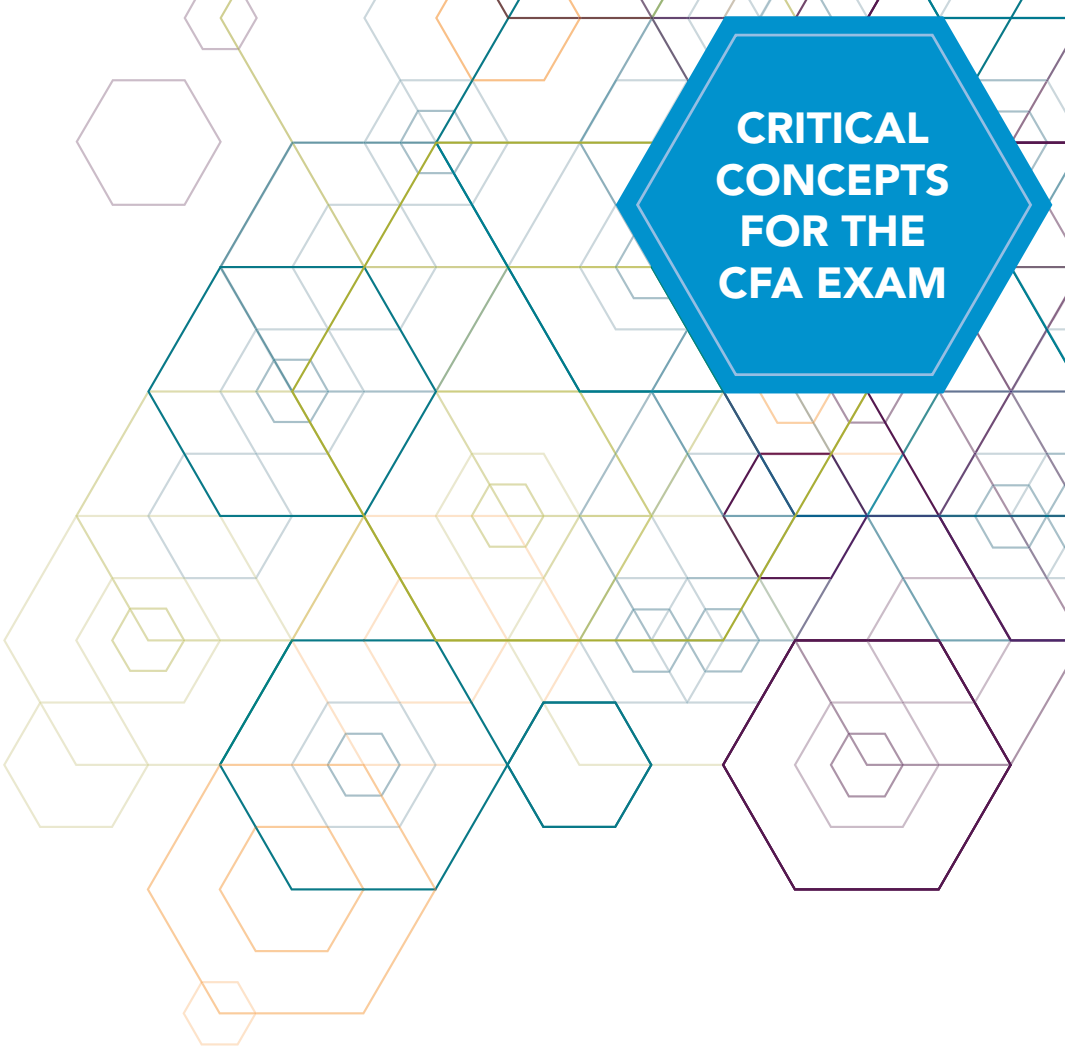
2020
CFA® EXAM REVIEW



WILEY'S CFA® PROGRAM LEVEL III SMARTSHEETS

FUNDAMENTALS FOR CFA EXAM SUCCESS

WILEY

WCID184

ETHICAL AND PROFESSIONAL STANDARDS

STANDARDS OF PROFESSIONAL CONDUCT

- Thoroughly read the Standards, along with related guidance and examples.

ASSET MANAGER CODE OF PROFESSIONAL CONDUCT

- Firm-wide, voluntary standards
- No partial claim of compliance.
- Compliance statement: "[Insert name of firm] claims compliance with the CFA Institute Asset Manager Code of Professional Conduct. This claim has not been verified by CFA Institute."
- Firms must notify CFA Institute when claiming compliance.
- CFA Institute does not verify manager's claim of compliance.
- Standards cover:
  - Loyalty to clients
  - Investment process and actions
  - Trading
  - Risk management, compliance, and support
  - Performance and valuation
  - Disclosures

GLOBAL INVESTMENT PERFORMANCE STANDARDS

- Focus on required disclosures, and presentation and reporting requirements and recommendations of GIPS.
- Be able to identify and correct errors in a performance presentation that claims to be GIPS compliant.

BEHAVIORAL FINANCE

BEHAVIORAL FINANCE PERSPECTIVE

- Prospect theory
  - Assigns value to changes in wealth rather than levels of wealth.
  - Underweight moderate- and high-probability outcomes.
  - Overweight low-probability outcomes.
  - Value function is concave above a wealth reference point (risk aversion) and convex below a wealth reference point (risk seeking).
  - Value function is steeper for losses than for gains.
- Cognitive limitations
  - Bounded rationality: deciding how much will be done to aggregate relevant information and using rules of thumb.
  - Satisficing: finding adequate rather than optimal solutions.
- Traditional perspective on portfolio construction assumes that managers can identify an investor's optimal portfolio from mean-variance efficient portfolios.
- Consumption and savings
  - Mental accounting: wealth classified into current income, currently owned assets, PV of future income.
  - Framing: source of wealth affects spending/saving decisions (current income has high marginal propensity to consume).
  - Self-control: long-term sources unavailable for current spending.
- Behavioral asset pricing models
  - Sentiment premium included in required return.
  - Bullish (bearish) sentiment risk decreases (increases) required return.
- Behavioral portfolio theory
  - Strategic asset allocation depends on the goal assigned to the funding layer.
  - Uses bonds to fund critical goals in the domain of gains.
  - Uses risky securities to fund aspirational goals in the domain of losses.
- Adaptive markets hypothesis
  - Must adapt to survive (bias towards previously successful behavior due to use of heuristics).
  - Risk premiums and successful strategies change over time.

BEHAVIORAL BIASES

- Cognitive errors (belief persistence biases)
  - Conservatism: overweight initial information and fail to update with new information.
  - Confirmation bias: only accept belief-confirming information, disregard contradictory information.
  - Representativeness: extrapolate past information into the future (includes base-rate neglect and sample-size neglect).
  - Illusion of control: believe that you have more control over events than is actually the case.
  - Hindsight bias: only remember information that reinforces existing beliefs.
- Cognitive errors (information-processing biases)
  - Anchoring and adjustment: develop initial estimate and subsequently adjust it up/down.
  - Mental accounting: treat money differently depending on source/use.
  - Framing: make a decision differently depending on how information is presented.
  - Availability bias: use heuristics based on how readily information comes to mind.
- Emotional biases
  - Loss aversion: strongly prefer avoiding losses to making gains (includes disposition effect, house-money effect and myopic loss aversion).
  - Overconfidence: overestimate analytical ability or usefulness of their information (prediction overconfidence and certainty overconfidence).
  - Self-attribution bias: self-enhancing and self-protecting biases intensify overconfidence.
  - Self-control bias: fail to act in their long-term interests (includes hyberbolic discounting).
  - Status quo bias: prefer to do nothing than make a change.
  - Endowment bias: value an owned asset more than if you were to buy it.
  - Regret aversion: avoid making decisions for fear of being unsuccessful (includes errors of commission and omission).
- Goals-based investing
  - Base of pyramid: low-risk assets for obligations/needs.
  - Moderate-risk assets for priorities/desires; speculative assets for aspirational goals.
- Behaviorally modified asset allocation
  - Greater wealth relative to needs allows greater adaptation to client biases
  - Advisor should moderate cognitive biases with high standard of living risk (SLR).
  - Advisor should adapt to emotional biases with a low SLR.

INVESTMENT PROCESSES

- Behavioral biases in portfolio construction
  - Inertia and default: decide not to change an asset allocation (status quo bias).
  - Naïve diversification: exhibit cognitive errors resulting from framing or using heuristics like 1/*n* diversification.
  - Company stock investment: overallocate funds to company stock.
  - Overconfidence bias: engage in excessive trading (includes disposition effect).
  - Home bias: prefer own country's assets.
  - Mental accounting: portfolio may not be efficient due to goals-based investing as each layer of pyramid is optimized separately.
- Behavioral biases in research and forecasting
  - Representativeness: due to excessive structured information.
  - Confirmation bias: only accept supporting evidence.
  - Gamblers' fallacy: overweight probability of mean reversion.
  - Hot hand fallacy: overweight probability of similar returns.
  - Overconfidence, availability, illusion of control, self-attribution and hindsight biases also possible.
- Market behavioral biases
  - Momentum effects due to herding, anchoring, availability and hindsight biases.
  - Bubbles due to overconfidence, self-attribution, confirmation and hindsight biases.
  - Value stocks have outperformed growth stocks; small-cap stocks have outperformed large-cap stocks.

CAPITAL MARKET EXPECTATIONS

CME FRAMEWORKS AND MACRO CONSIDERATIONS

- Good forecasts are:
  - Objective and unbiased
  - Internally consistent
  - Efficient with low errors
    - Uncertainty and errors stem from choosing incorrect model, errors in underlying data, or errors in estimated parameters
    - Errors can also stem from behavioral biases such as anchoring bias, availability bias, confirmation bias, status quo bias, overconfidence bias, and prudence bias
- Aggregate equity market value:

$$\begin{aligned} V_t^e &= \text{GDP}_t \times S_t^k \times PE_t \\ &= \text{GDP}_t \times \frac{E_t}{\text{GDP}_t} \times \frac{P_t}{E_t} \end{aligned}$$

- Three distinct approaches to forecasting economic change:
  - Econometrics
  - Economic indicators
  - Checklist approach
- Yield curve over the business cycle
  - Initial recovery – Steep yield curve with low short-term rates that start to rise
  - Early expansion – Rising curve with steep short maturities and flat long maturities
  - Late expansion – Slowly rising and flattening curve
  - Slowdown – Flat or inverted curve that is falling
  - Contraction – Falling curve that begins to steepen

FORECASTING ASSET CLASS RETURNS

- Expected returns on fixed income securities can be determined using:
  - A DCF approach, whereby current price and future cash flows infer a yield to maturity (YTM). Realised return differ from YTM due to gains/losses from pre-maturity transactions and reinvestment effects
  - A building block approach, whereby expected return is based on the short-term nominal default-free rate plus risk premiums such as a term premium, credit premium and liquidity premium
- Expected returns on equities can be determined using:
  - Historical statistics

- A DCF/dividend discount approach, such as the Grinold-Kroner model:

$$E(R_e) \approx \frac{D}{P} + (\%\Delta E - \%\Delta S) + \%\Delta P/E$$

- A building block approach, whereby expected return is based on either the short-or-long-term nominal default-free rate plus risk premiums such as those used for fixed income securities as well as an equity risk premium
- An equilibrium approach, whereby expected return for an equity market is based on its sensitivity (β) to global market returns and its level of integration (φ) with global markets (Singer-Terhaar model):

$$\begin{aligned} RP_i &= \varphi RP_i^G + (1-\varphi)\,RP_i^S \\ &\text{where:} \\ \varphi &= \text{degree of global integration} \\ RP_i^G &= \text{risk premium under global equilibrium (integrated)} \\ RP_i^S &= \text{risk premium under local-market equilibrium (segmented)} \end{aligned}$$

and

$$RP_i^G = \beta_{i,GM} RP_{GM}$$

- Expected returns on real estate can be determined using:
  - Capitilization rates:

$$E(R_{re}) - \text{Cap rate} + g_{NOI}$$

  - A building block approach, whereby expected return is based on risk premia that incorporate those used for both fixed income securities and equities
  - An equilibrium approach, with adjustments for illiquidity and smoothed returns
- Expected returns for foreign exchange can be determined using:
  - A monetary approach, whereby exchange rate movements reflect the expected differences in inflation
  - Capital flows, whereby expected changes in exchange rates is based on differences between countries in default-free rates and risk premiums

$$E(R_{re}) - \text{Cap rate} + g_{NOI}$$

  - A building block approach, whereby expected return is based on risk premia that incorporate those used for both fixed income securities and equities
  - Expected return for emerging market securities is likely to include considerations for ability and willingness to pay (fixed income) and risks to shareholder protections (equities)
  - Expected variance of returns and covariances can be determined using:
  - Historical statistics
  - Factor models, that seek to reduce problems associated with historical statistics. Shrinkage estimation, using historical statistics and factor model outputs can provide further precision
  - Smoothing, especially in the case of illiquid markets:

$$\begin{aligned} R_t &= (1-\lambda)\,r_t + \lambda R_{t-1} \\ &0 < \lambda < 1 \\ \text{var}(r) &= \left(\frac{1+\lambda}{1-\lambda}\right)\text{var}(R) > \text{var}(R) \end{aligned}$$

- ARCH models, that seek to account for volatility clustering of returns

ASSET ALLOCATION

ASSET ALLOCATION APPROACHES

- Asset-only: does not explicitly model liabilities
- Liability-relative (liability-driven investing): aims at an asset allocation that can pay off liabilities when they come due.
- Goals-based investing: specifies sub-portfolios aligned with a specific goal (sum of all sub-portfolio asset allocations results in an overall strategic asset allocation).

PRINCIPLES OF ASSET ALLOCATION

- Mean variance optimization (MVO)
  - Produces an efficient frontier based on returns, standard deviation of returns and pairwise correlations.
  - Finds optimal asset allocation mix that maximizes client's utility.

$$U_p = E(R_p) - 0.005 \times A \times \sigma_p^2$$

- MVO limitations
  - Asset allocations are highly sensitive to small changes in input variables.
  - Asset allocations can be highly concentrated.
  - Only focuses on mean and variance of returns.
  - Sources of risk may not be well diversified.
  - Asset-only strategy.
  - Single-period framework and ignores trading/rebalancing costs and taxes.
  - Does not address evolving asset allocation strategies, path-dependent decisions, non-normal distributions.
- Approaches to improve quality of MVO asset allocation
  - Use reverse optimization to compute implied returns and improve quality of inputs, e.g. Black-Litterman model.
  - Adding constraints to incorporate short-selling and other real-world restrictions into optimization.
  - Resampled MVO technique combining MVO and Monte Carlo approaches to seek the most efficient and consistent optimization.
- Monte Carlo simulation and scenario analysis
  - Used in a multiple-period framework to improve single-period MVO.
  - Provides a realistic picture of distribution of potential future outcomes.
  - Can incorporate trading/rebalancing costs and taxes.
  - Can model non-normal distributions, serial and cross-sectional correlations, evolving asset allocations, path-dependent decisions, non-traditional investments, human capital.
- Risk budget
  - Identifies total amount of risk and allocates risk to different asset classes.
  - Asset allocation is optimal when ratio of excess return to MCTR is the same for all assets.

Marginal contribution to total risk (MCTR) = Asset beta × Portfolio standard deviation
Absolute contribution to total risk (ACTR) = Asset weight × MCTR
Ratio of excess return to MCTR = (Expected return − Risk-free rate)/MCTR

- Liability-relative asset allocation approaches

Surplus Optimization	Two-Portfolio	Integrated Asset-Liability
Simplicity	Simplicity	Increased complexity
Linear correlation	Linear or nonlinear correlation	Linear or nonlinear correlation
All levels of risk	Conservative level of risk	All levels of risk
Any funding ratio	Positive funding ratio for basic approach	Any funding ratio
Single period	Single period	Multiple periods

- Goal-based asset allocations
  - Creation of differentiated portfolio modules based on capital market expectations.
  - Identifying clients' goals and matching the goals to appropriate sub-portfolios and modules.

ASSET ALLOCATION WITH REAL-WORLD CONSTRAINTS

- Constraints on asset allocation due to:
  - Asset size: more acute issue for individual rather than institutional investors.
  - Liquidity: liquidity needs of asset owner and liquidity characteristics of different asset classes.
  - Time horizon: asset allocation decisions evolve with changes in time horizon, human capital, utility function, financial market conditions, characteristics of liability and the asset owner's priorities.
  - Regulatory: financial markets and regulatory entities often impose additional constraints.
- Taxes
  - Place less tax-efficient assets in tax-advantaged accounts to achieve after-tax portfolio optimization.

$$r_{at} = p_d r_{pt}(1-t_d) + p_d r_{pt}(1-t_{cg})$$

  - Rebalancing range for a taxable portfolio ($R_{taxable}$) can be wider than those of an otherwise identical tax-exempt portfolio (R_{tax} exempt).

$$R_{\text{taxable}} = R_{\text{tax exempt}} / (1-t)$$

- Revision to asset an allocation
  - Changes in goals
  - Changes in constraints
  - Changes in investment beliefs
- Tactical asset allocation (TAA) approaches
  - Discretionary TAA: uses market timing skills to avoid or hedge negative returns in down markets and enhance positive returns in up markets.
  - Systematic TAA: uses signals to capture asset-class-level return anomalies that have been empirically demonstrated as producing abnormal returns.
- Behavioral biases in asset allocation
  - Loss aversion: mitigate by framing risk in terms of shortfall probability or funding high-priority goals with low-risk assets.
  - Illusion of control: mitigate by using the global market portfolio as a starting point and using a formal asset allocation process based on long-term return and risk forecasts, optimization constraints anchored around asset class weights in the global market portfolio, and strict policy ranges.
  - Mental accounting: goal-based investing incorporates this bias directly into the asset allocation solution by aligning each goal with a discrete sub-portfolio.
  - Recency or representativeness bias: mitigate by using a formal asset allocation policy with prespecified allowable ranges.
  - Framing bias: mitigate by presenting the possible asset allocation choices with multiple perspectives on the risk-reward tradeoff.
  - Familiarity or availability bias: mitigate by using the global market portfolio as the starting point in asset allocation and carefully evaluating any potential deviations.

EQUITY PORTFOLIO MANAGEMENT

- Approaches to managing equity portfolios
  - Passive management: try to match benchmark performance.
  - Active management: seek to outperform benchmark by buying outperforming stocks and selling underperforming stocks.
  - Semiactive management (enhanced indexing): seek to outperform benchmark with limited tracking risk (highest information ratio).
- Approaches to constructing an indexed portfolio
  - Full replication: minimal tracking risk but high costs.
  - Stratified sampling: retains basic characteristics of index without costs associated with buying all the stocks.
  - Optimization: seeks to match portfolio's risk exposures (including covariances) to those of the index but can be misspecified if historical risk relationships change

over time.
- Value style investing: low P/E, contrarian, high yield.
- Growth style investing: consistent growth, earnings momentum.
- Market-oriented (blend or core style) investors: market-oriented with a value bias, market-oriented with a growth bias, growth at a reasonable price, style rotators.
- Market cap approach: small-cap, mid-cap, large-cap investors.
- Investment style analysis
  - Holdings-based: analyses characteristics of individual security holdings.
  - Returns-based: regressing portfolio returns on returns of a set of securities indices (betas are the portfolio's proportional exposure to the particular style represented by index).
- Price inefficiency on the short side
  - Restrictions to short selling.
  - Management's tendency to deliberately overstate profits.
  - Sell-side analysts issue fewer sell recommendations.
  - Sell-side analysts are reluctant to issue negative opinions.
- Sell disciplines
  - Substitution: opportunity cost sell and deteriorating fundamentals sell.
  - Rule-driven: valuation-level sell, down-from-cost sell, up-from-cost sell, target price sell.
- Semiactive equity strategies
  - Derivative-based semiactive equity strategies: exposure to equity market through derivatives and enhanced return through non-equity investments, e.g. fixed income.
  - Stock-based enhanced indexing strategies: portfolio looks like benchmark except in those areas on which the manager explicitly wishes to bet on (within risk limits) to generate alpha.
  - Information ratio (Grinold and Kahn)

$$IR \approx IC\sqrt{Breadth}$$

- Core-satellite portfolio: index and semiactive managers constitute core holding while active managers represent satellites.
- Total active return and risk
  - Manager's true active return = Manager's return – Manager's normal benchmark
  - Manager's misfit active return = Manager's normal benchmark – Investor's benchmark
  - Total active risk

$$\text{Manager's total active risk} = \sqrt{(\text{Manager's "true" active risk})^2 + (\text{Manager's "misfit" active risk})^2}$$

  - Information ratio as measure of manager's risk adjusted performance

$$IR = \frac{\text{Manager's "true" active return}}{\text{Manager's "true" active risk}}$$

ALTERNATIVE INVESTMENTS

HEDGE FUND STRATEGIES

- Equity:
  - Long-short – Seek alpha from long and short opportunities (as well as beta from net long exposure). Alpha might also be chased by "beta-tilting" and risk factor exposures will be influenced by strategy focus, use of leverage, and willingness to hold positions over time
  - Dedicated short-selling and short-bias – Dedicated short-selling strategies seek returns from short positions only, whereas short-bias strategies may balance their portfolios with long positions
  - Market neutral – This includes pairs trading (e.g. selling company A, buying company B), stub trading (e.g. selling parent and buying subsidiary) and multi-class trading (e.g. selling class A shares in company X, while buying their class B shares).
- Event driven:
  - Merger arbitrage – Seek returns from the price volatility accompanying takeover bids of acquiring company's stock and target company's equity and debt securities
  - Distressed securities – Buying securities of companies in financial distress and facing bankruptcy to take advantage of low price and the restructuring of the company
- Relative value:
  - Fixed income arbitrage – Exploiting various aspects of mispricing of risk premiums between securities. Strategy managers will tend to hedge/immunize against market risks such as duration, sovereign risk, currency risk, credit risk and prepayment risk
  - Convertible bond arbitrage – Seek returns from delta hedging and gamma trading short equity hedges against the potential long equity exposure within convertible bonds
- Opportunistic:
  - Global macro – Seek returns through trading of currencies, bonds and derivatives based on expectations of the relative economic health of countries and potential economic policy changes
  - Managed futures – Systematically seek returns from technical analysis of markets and signals of expected movements in futures prices across all global markets.
- Specialist:
  - Volatility – Seeks returns through the implied volatility captured in option prices by buying cheap volatility and selling expensive volatility
  - Insurance-linked – Seeks returns from investing and trading in reinsurance securities (e.g. cat-bonds) or life settlements (i.e. purchasing of life policies with attractive surrender values and mortality characteristics)
- Multi-manager:
  - Multistrategy – Combination of the above strategies in the one fund
  - Fund of funds – A manager that invests in other hedge funds that will generally have multiple layers of management and fees

ASSET ALLOCATION TO ALTERNATIVES

- Private equity
  - Limited diversification benefits but can provide additional return via the liquidity risk premium
- Hedge funds
  - Role in a portfolio will depend on strategy but might help to trade-off between equity market alpha and beta or provide a source of uncorrelated returns
- Real assets
  - Provide portfolios with inflation hedging
  - Low correlation to equities
- Private real estate
  - Can provide additional inflation protection (as well as access to illiquidity premium)
- Private credit
  - Low correlation to equities
  - Provides access to less liquid debt
- Alternatives might be classified based on:
  - Traditional asset class counterparts (equities, fixed income, real estate)
  - Macroeconomic performance (normal economy, inflationary economy, deflationary economy)
  - Exposure to risk factors (equity market, size, value, liquidity, duration, inflation, credit, currency)

PRIVATE WEALTH MANAGEMENT

ADVISING PRIVATE CLIENTS

- Compared to institutional clients, private clients tend to have:
  - objectives that are goals-based, less-defined and less stable
  - multiple, finite time horizons
  - informal/limited governance structure
- - Private wealth manager skills include:
  - - technical skills such as financial planning knowledge, capital market proficiency and portfolio construction ability
  - soft skills such as communication, social, coaching and business development skills
- Private clients can be segmented into mass affluent, high-net-wealth (HNW), and ultra-high-net-wealth segments
- - Private client objectives are likely to include return objectives, retirement goals, funding priorities, investment preferences and risk tolerance
- Tax for private clients might be based on level of income, wealth and/or consumption
- Tax strategies employed by private clients might include:
  - tax avoidance - utilizing tax mechanisms/concessions
  - tax reduction - investing in tax-effective assets
  - tax deferral - preference for capital gains over income
- Capital sufficiency for a private client assessed by using:
  - deterministic forecasting, which uses expected returns and cashflows to determine the expected level of capital over time
  - Monte Carlo simulation, which utilises probability distributions of returns and cashflows to produce a range of possible outcomes over time
- Retirees exhibit four main behavioral tendencies in their financial planning being:
  1. heightened loss aversion
  2. consumption gap
  3. annuity puzzle
  4. income preference
- The Investment Policy Statement (IPS) for a private client includes:
  - Background and investment objectives
  - Investment parameters
  - Portfolio asset allocation
  - Portfolio management
  - Duties and responsibilities
  - IPS appendix
- The two main portfolio construction approaches for private clients are:
  1. Traditional approach, which starts with finding the efficient frontier (based on asset classes and capital market expectations) and ends with portfolio allocations (based on investment constraints, preferences and asset location)
  2. Goals-based approach, which can also start with finding the efficient frontier but ends up with multiple portfolios, each with different objectives based on the various goals of the client

TAXES AND PRIVATE WEALTH MANAGEMENT

- Future value factor with accrual taxes

$$FVIF_{\text{pre-tax}} = (1 + r_{\text{pre-tax}})^n$$
$$FVIF_{\text{after-tax}} = [1 + r_{\text{pre-tax}}(1 - t_I)]^n$$

- Future value factor when deferring taxes on capital gains (B is cost basis as a proportion of current market value)

$$FVIF_{CG} = (1 + r_{\text{pre-tax}})^n (1 - t_{CG}) + t_{CG}B$$

- Future value factor with annual wealth tax

$$FVIF_W = \left[(1 + r_{\text{pre-tax}})(1 - t_W)\right]^n$$

- Effective annual after-tax return after taxes, interest, dividends, and realized capital gains

$$r^* = r_T\left(1 - P_I t_I - P_D t_D - P_{CG} t_{CG}\right)$$

- Effective capital gains tax rate

$$T^* = t_{CG}\left(\frac{1 - P_I - P_D - P_{CG}}{1 - P_I t - P_D t_D - P_{CG} t_{CG}}\right)$$

- Future value factor with blended tax regime

$$FVIF_{\text{after-tax}} = (1 + r^*)^n (1 - T^*) + T^* - t_{CG}(1 - B)$$

- Accrual equivalent after-tax return

$$V_n = V_0\left(1 + r_{AE}\right)^n$$
$$r_{AE} = \sqrt[n]{\frac{V_n}{V_0}} - 1$$

- Accrual equivalent tax rate

$$r_{AE} = r\left(1 - T_{AE}\right)$$
$$T_{AE} = 1 - \frac{r_{AE}}{r}$$

- Measure of tax drag = Difference between accrual equivalent after-tax return and the actual return of the portfolio.
- Tax-deferred accounts (TDAs): contributions from untaxed ordinary income, tax-free growth during the holding period, taxed at time of withdrawal

$$FVIF_{TDA} = (1 + r)^n (1 - t_n)$$

- Tax-exempt accounts (TEAs): after-tax contributions, tax-free growth during the holding period, no future tax liabilities.

$$FVIF_{TEA} = (1 + r)^n$$

- TDA offers after-tax return advantage over TEA if tax rate at withdrawal is lower than tax rate at initial contribution.
- Investor's shared of investment risk on a taxed return

$$\sigma_{AT} = \sigma(1 - t)$$

ESTATE PLANNING

- Core capital
  - Assets for maintaining lifestyle, funding desired spending goals and providing emergency reserve.
  - Joint survival probability for a couple

$$p(survival_J) = p(survival_H) + p(survival_W) - p(survival_H) \times p(survival_W)$$

  - PV of joint spending needs

$$PV(spending_J) = \sum_{t=1}^{N} \frac{p(survival_J) \times (spending_J)}{(1 + r)^t}$$

- Relative after-tax value of a tax-free gift

$$RV_{tax-freeGift} = \frac{FV_{Gift}}{FV_{Bequest}} = \frac{[1 + r_g(1 - t_{ig})]^n}{[1 + r_e(1 - t_{ie})]^n (1 - T_e)}$$

- Relative after-tax value of a gift taxable to the recipient

$$RV_{taxable\ Gift} = \frac{FV_{Gift}}{FV_{Bequest}} = \frac{[1 + r_g(1 - t_{ig})]^n (1 - T_g)}{[1 + r_e(1 - t_{ie})]^n (1 - T_e)}$$

- Trusts
  - Revocable: owner (settlor) retains right to assets and can use trust assets to settle claims against settlor.
  - Irrevocable: owner forfeits right to assets and cannot use trust assets to settle claims against settlor.
- Double taxation
  - Credit method: residence country provides a tax credit for taxes paid in source country.

$$t_{CM} = Max\left(t_{RC}, t_{SC}\right)$$

  - Exemption method: residence country exempts foreign source income from tax.

$$t_{EM} = t_{SC}$$

  - Deduction method: residence country allows deduction for tax paid in source country.

$$t_{DM} = t_{RC} + t_{SC} - t_{RC} t_{SC}$$

CONCENTRATED SINGLE-ASSET POSITIONS

- Objectives: risk reduction (diversification), monetization, tax optimization, control.
- Considerations: illiquidity, triggering taxable gains on sale, restrictions on amount and timing of sales, emotional and cognitive biases.
- Monetization strategies
  - Monetization by (1) hedging the position, and (2) borrowing against hedged position.
  - Hedging for monetization strategies can be achieved by: (1) short sale against the box (least expensive); (2) total return equity swap; (3) short forward or futures contract; (4) synthetic short forward (long put and short call).
- Hedging strategies
  - Buy puts (protect downside and keep upside while deferring capital gains tax).
  - Use zero-premium collars (long put and short call with offsetting premiums) to reduce costs vs buying puts.
  - Use prepaid variable forward (combine hedge and margin loan in same instrument), with number of shares delivered at maturity dependent on share price at maturity.
- Yield enhancement strategies:
  - Write covered calls to generate income.
  - Does not reduce downside risk.
- Tax optimized equity strategies
  - Index-tracking separately managed portfolio: designed to outperform benchmark from an investment and tax perspective.
  - Completeness portfolio: tracks index given concentrated portfolio characteristics and new investments.
- Exchange fund: investors with concentrated positions contribute these positions in exchange for a share in a diversified fund (non-taxable event).
- Monetization strategies for concentrated private shares
  - Strategic buyers: gain market share and earnings growth.
  - Financial buyers: acquire and manage companies using private equity fund.
  - Leveraged recapitalization: private equity firm uses debt to purchase majority of owner's stock for cash.
  - Management buyout: management borrow money to purchase owner's stock.
  - Divestiture of noncore assets: owner uses proceeds to diversify asset pool.
  - Sale or gift to family members.
  - Personal line of credit secured by company shares.
  - Initial public offering.
  - Employee share ownership plan (ESOP) exchange: company buys owner's shares for ESOP distributions.
- Monetization strategies for real estate
  - Mortgage financing (no tax consequences and can use proceeds to diversify).
  - Donor-advised funds (contribute property now for tax deduction).
  - Sale and leaseback (frees up capital for diversification but sale triggers taxable gain).

RISK MANAGEMENT FOR INDIVIDUALS

- Financial capital: includes all tangible assets including family home
- Human capital: PV of future expected labor income (higher income volatility requires higher discount rate).
- Income volatility risk can be diversified by appropriate financial capital, e.g. if human capital is equity-like, financial capital should contain more bonds.
- Economic (holistic) balance sheet
  - Assets: financial capital, personal property, human capital, pension value.
  - Liabilities: total debt, lifetime consumption needs, bequests.
  - Net wealth is the difference between total assets and total liabilities.
- Young family has high % of economic assets in human capital. As the household ages, weight of human (financial) capital will decrease (increase).
- Risks to human and financial capital
  - Earnings risk: protect against earnings risk related to injury with disability insurance.
  - Premature death (mortality risk): protect with life insurance.
  - Longevity risk: protect with annuities.
  - Property risk: protect with homeowner's insurance.
  - Liability risk: protect with liability insurance.
  - Health risk: protect with health insurance.
- Risk management techniques

Loss Characteristics	High Frequency	Low Frequency
High severity	Risk avoidance	Risk transfer
Low severity	Risk reduction	Risk retention

- Adequacy of life insurance
  - Human life value method: estimates the PV of earnings that must be replaced.
  - Needs analysis method: estimates financial needs of dependents.

INSTITUTIONAL INVESTORS

SOVEREIGN WEALTH FUNDS

- SWF types include:
  - budget stabilization funds (used by commodity exporting countries)
  - development funds (reserves ear marked for big projects)
  - pension reserve funds (similar to private sector defined benefit funds)
  - reserve funds (investing of foreign exchange reserves to enhance return)
  - savings funds (used for multi-generational national wealth transfer)
- Risk tolerance/objective: range of risk tolerance based on SWF type generally related to time horizon (budget stabilzation funds have lower risk tolerance; savings funds have higher tolerances)
- Return objective:
  - budget stabilization funds seek returns uncorrelated with business cycle
  - development funds look for a return greater than GDP growth
  - pension reserve funds seek long-term returns in line with pension liabilities
  - reserve funds seek a return in excess of monetary stabilization bond yield
  - savings funds seek some real target return
- Liquidity: generally related to time horizon
- Time horizon:
  - budget stabilization funds - short-term
  - development funds - medium to long-term
  - pension reserve funds - long-term
  - reserve funds - very long-term
  - savings funds - long-term

- Tax: SWFs generally enjoy tax-free status in their jurisdictions
- Legal/regulatory: SWF's are generally established by way of legislation. Many have adopted the Santiago Principles that addresses governance and best-practice

DEFINED BENEFIT PENSION PLAN

- Risk tolerance: greater ability to assume risk if
  - Plan surplus
  - Lower sponsor debt and/or higher current profitability
  - Lower correlation of plan asset returns with company profitability
  - No early retirement and lump sum distributions options
  - Greater proportion of active versus retired lives
  - Higher proportion of younger workers
- Risk objective: usually related to shortfall risk of achieving funding status.
- Return objective: to achieve a return that will fully fund liabilities (inflation-adjusted), given funding constraints.
- Liquidity: to meet required benefit payments.
- Time horizon: usually long-term and could be multi-stage.
- Tax: investment income and capital gain usually tax-exempt.
- Legal/regulatory: plan trustees have a fiduciary responsibility to beneficiaries under ERISA (US).
- Unique: limited resources for due diligence, ethical constraints.

FOUNDATIONS

- Risk tolerance/objective: higher risk tolerance due to noncontractually committed payout.
- Return objective: to cover inflation-adjusted spending goals and overheads not countable toward required spending minimum.

$$r = \%\text{ spend} + \%\text{ management} + \%\text{ inflation}$$
or
$$= (1 + \%\text{ spend})(1 + \%\text{ management})(1 + \%\text{ inflation}) - 1$$

- Liquidity: to quickly fund spending needs (including noncountable overheads) greater than current contributions.
- Time horizon: usually infinite.
- Tax: investment income and capital gain taxable.
- Legal/regulatory: UPMIFA (US).
- Unique: May use swap agreements or other transactions to diversify returns if funding is primarily via large blocks of stocks.

ENDOWMENTS

- Risk tolerance/objective
  - Greater ability to take risk due to infinite time horizon and if adopting spending rules based on smoothed averages of return and previous spending.
  - Lower ability to take risk if high donor contributions as a % of total spend.
  - Lower ability to take risk if contributing a significant % to a company's annual spending or if company relies on endowment to cover high fixed costs.
- Return objective: same as for foundations. Annual spend may be calculated in a number of ways.

$$\text{Spending}_t = \text{Spending rate} \times \text{Ending market value}_{t-1}$$

$$\text{Spending}_t = \text{Spending rate} \times \tfrac{1}{3}\,[\text{Ending market value}_{t-3} + \text{Ending market value}_{t-2} + \text{Ending market value}_{t-1}]$$

$$\text{Spending}_t = \text{Smoothing rate} \times [\text{Spending}_{t-1} \times (1 + \text{Inflation}_{t-1})] + [(1 - \text{Smoothing rate}) \times (\text{Spending rate} \times \text{Beginning market value}_{t-1})]$$

- Liquidity: to fund gifts and planned capital distributions for construction projects as well as to allow portfolio rebalancing. No minimum spending requirement.
- Time horizon: usually infinite (maintain principal in perpetuity).
- Tax: not taxable unless they are unrelated business taxable income.
- Legal/regulatory: UPMIFA (US).
- Unique: types of investments constrained by size or board member sophistication.

LIFE INSURANCE COMPANIES

- Risk tolerance/objective
  - Liquidity risk: arises from changes in investment portfolio that affects reserves.
  - Interest rate risk: reinvestment risk and valuation risk (due to duration mismatch between assets and liabilities).
  - Credit risk of bond investments.
  - Cash volatility risk: relates to timely receipt and reinvestment of cash.
  - Disintermediation risk: policy owners withdraw funds to reinvest with other intermediaries in higher-returning assets.
- Return objective: minimum return requirement (based on rate initially specified to fund life insurance contract) and net interest spread.
- Liquidity: limited liquidity needs since cash inflows exceed cash outflows, but need to consider disintermediation risk (when interest rates are rising) and asset marketability risk.
- Time horizon: different product lines have different time horizons and will be funded by duration-matched assets.
- Tax: pay corporate tax.
- Legal/regulatory: regulations on eligible investments, prudent investor rule, NAIC risk-based capital (RBC) and asset valuation reserve (AVR) requirements.
- Unique: look out for restrictions on illiquid investments.

NON-LIFE INSURANCE COMPANIES

- Risk tolerance/objective
  - Policyholder reserves use lower-risk assets due to unpredictable operating claims.
  - Maintaining surplus during high-volatility markets reduces ability to accept higher risk.
  - Risk measured against premiums-to-capital and premiums-to-surplus ratios.
- Return objective
  - Investment earnings on surplus assets must be sufficient to offset periodic losses and to maintain policyholder reserves.
  - Larger companies use active management strategies for total return rather than yield or investment income strategies.
- Liquidity: to meet policyholder claims.
- Time horizon: generally shorter duration than life insurance companies.
- Tax: pay corporate tax.
- Legal/regulatory: regulations on eligible investments, risk-based capital (RBC) requirements.
- Unique: look for restrictions on illiquid investments.

BANKS

- Risk tolerance/objective
  - Below-average risk tolerance.
  - Leverage-adjusted duration gap (LADG) measure overall interest rate exposure.

$$LADG = D_A - kD_L$$
$$k = V_L / V_A$$

  - Value at risk (VAR) measures minimum loss expected over a specified time period at a given level of probability.
  - Credit risk in the bank's loan portfolio.
- Return objective: interest income allocation focuses on positive spread over cost of funds, with the remaining allocation focusing on higher total return.
- Liquidity: driven by demand for loans and net outflows of deposits.
- Time horizon: duration spread of assets over liabilities constrains time horizon for securities portfolio to an intermediate-term.
- Tax: pay corporate tax.
- Legal/regulatory
  - Large % of securities portfolio in government securities as pledge against reserves.
  - Regulators restrict allocation to common shares and below-investment-grade bonds.
  - Risk-based capital requirements.
- Unique: Lending activities may be influenced by community needs and historical banking relationships.

DERIVATIVES AND CURRENCY MANAGEMENT

OPTIONS

- Option strategies

Strategy	Construction using European options	Motivation
Covered call	Own underlying share and sell call on share.	Earn premium to cushion losses.
Protective put	Own underlying share and buy put on share.	Downside protection with upside potential.
Bull spread	Buy call at lower strike and sell call at higher strike (can use puts instead of calls)	Speculation on stock price increase in a range
Bear spread	Buy call at higher strike and sell call at lower strike (can use puts instead of calls)	Speculation on stock price decrease in a range
Butterfly spread	Buy call at lower strike, buy call at higher strike, sell two calls at strike halfway between strikes of long calls (can use puts instead of calls)	Bet on low volatility
Collar	Buy stock, buy put and sell call. (zero-cost collar if call and put premiums are the same)	Downside protection and with limited upside
Straddle	Buy call and put with same strike	Bet on high volatility
Strap	Buy two calls and one put with same strike	Bet on high volatility (stock price rise more likely)
Strip	Buy one call and two puts with same strike	Bet on high volatility (stock price fall more likely)
Strangle	Buy call and put, put has different exercise price	Bet on high volatility
Box spread	Bull call spread and bear put spread	Replicate risk-free return or make arbitrage profit

- Interest rate options
  - Buy interest rate call option to protect a future borrowing against interest rate increases.

$$\text{Interest rate call option payoff} = \text{Notional principal} \times \max(\text{Underlying rate at expiration} - \text{Exercise rate}, 0) \times \frac{\text{Days in underlying rate}}{360}$$

  - Buy interest rate put option to protect a future lending (or investing) transaction against interest rate declines.

$$\text{Interest rate put option payoff} = \text{Notional principal} \times \max(\text{Exercise rate} - \text{Underlying rate at expiration}, 0) \times \frac{\text{Days in underlying rate}}{360}$$

  - Cap: series of interest rate call options.
  - Floor: series of interest rate put options.
  - Interest rate collar to protect a future borrowing: buy interest rate cap and sell interest rate floor.
- Option Greeks
  - Option delta: positive for long call; negative for long put

$$\text{Option delta} = \frac{\text{Change in option price}}{\text{Change in underlying stock price}} = \frac{\Delta c}{\Delta S}$$

  - Option gamma: greatest for options that are at-the-money and close to expiration.

$$\text{Option gamma} = \frac{\text{Change in option delta}}{\text{Change in underlying stock price}}$$

FORWARD AND FUTURES

- Managing equity market risk and changing equity asset allocation by beta adjustment

$$N_f = \left(\frac{\beta_T - \beta_S}{\beta_f}\right)\left(\frac{S}{f}\right)$$

- Creating synthetic stock index fund or converting equity into cash

$$N_f^* = \text{Round}\left[\frac{V(1+r)^T}{fq}\right]$$

where V is the amount of money to be invested, r is the risk-free rate, T is the investment horizon, q is the futures contract price multiplier, f is the stock index futures price, and N_f^* is an integer representing the number of long stock index futures contracts to convert a cash position to an equity position or the number of short stock index futures contracts to convert an existing equity position into a cash position.

- Changing bond asset allocation

$$N_{Bf} = \left(\frac{MDUR_T - MDUR_S}{MDUR_f}\right)\frac{B}{f_B}\beta_y$$

SWAPS

- Duration of interest rate swaps

Duration [Pay fixed and receive floating interest rate swap] = Duration(Floating-rate bond) − Duration (Fixed-rate bond)

Duration [pay floating and receive fixed interest rate swap] = Duration (Fixed-rate bond) − Duration (Floating-rate bond)

- Use pay floating and receive fixed interest rate swap to increase duration of bond portfolio.
- Use pay fixed and receive floating interest rate swap to reduce duration of bond portfolio.
- Duration management using an interest rate swap

$$NP = V_P\left(\frac{MDUR_T - MDUR_P}{MDUR_S}\right)$$

- Uses of currency swap
  - Convert loan in one currency into a loan in another currency.
  - Convert foreign cash receipts into domestic currency.
- Uses of equity swap
  - Diversify a concentrated portfolio.
  - Achieve international diversification.
  - Change asset allocation between stocks and bonds.
- Swaptions
  - Payer swaption: holder has right to enter interest rate swap as fixed-rate payer (in-the-money when interest rates go up).
  - Receiver swaption: holder has right to enter interest rate as fixed-rate receiver (in-the-money when interest rates go down).

CURRENCY MANAGEMENT

- Domestic return on global asset (where exchange rate is expressed as $S_{DC/FC}$)

$$R_{DC} = (1+R_{FC})(1+R_{FX}) - 1$$

- Portfolio return in domestic currency terms

$$R_{DC} = [w_1 \times (1+R_{FC1})(1+R_{FX1}) + w_2 \times (1+R_{FC2})(1+R_{FX2})] - 1$$

- Variance of the domestic return

$$\sigma^2(R_{DC}) \approx \sigma^2(R_{FC}) + \sigma^2(R_{FX}) + [2 \times \sigma(R_{FC}) \times \sigma(R_{FX}) \times \rho(R_{FC}, R_{FX})]$$

- Factors favoring more currency hedging
  - Significant short-term objectives, e.g. income/liquidity requirements.
  - Global fixed-income investments.
  - Markets with high currency or asset volatility.
  - High risk aversion.
  - Doubt about value of currency return potential.
  - Lower possibility of regret if the hedge is not profitable.
  - Low costs of hedging.
- Hedging strategies
  - Passive hedging: manager protects portfolio with full hedging.
  - Discretionary hedging: manager reduces risk with hedging but has discretion to make currency bets for return enhancement.
  - Active currency management: manager seeks alpha by making currency bets.
  - Currency overlay: currency management outsourced to specialists.
- Active currency management
  - Economic fundamentals: real exchange rate will eventually converge to fair market values, with short-term increases in the domestic currency due to (1) increase in domestic currency's real purchasing power, (2) higher domestic interest rates, (3) higher expected foreign inflation, and (4) higher foreign risk premiums.
  - Technical analysis: based on belief that historical currency patterns will repeat over time and those repetitions are predictable.
  - Carry trade: borrow in lower interest rate (or forward premium) currencies and invest in higher interest rate (or forward discount) currencies, based on assumption that uncovered interest rate parity does not hold.
  - Roll yield: positive when trading the forward rate bias (buying base currency at forward discount or selling base currency at forward premium); negative when trading against the forward rate bias (selling base currency at forward discount or buying base currency at forward premium).

$$F_{FC/DC} = S_{FC/DC} \times \frac{1 + (i_{FC} \times \frac{\text{Actual}}{360})}{1 + (i_{DC} \times \frac{\text{Actual}}{360})}$$

$$F_{PC/BC} = S_{PC/BC} \times \frac{1 + (i_{PC} \times \frac{\text{Actual}}{360})}{1 + (i_{BC} \times \frac{\text{Actual}}{360})}$$

  - Volatility trade: long (short) straddle or strangle if volatility expected to increase (decrease).
- Currency management tools

Forward Contracts	Over-/under-hedging	Profit from market view
Option Contracts	OTM options	Cheaper than ATM
	Risk reversals	Write options to earn premiums
Exotic Options	Put/call spreads	Write options to earn premiums
	Seagull spreads	Write options to earn premiums
	Knock-in/out features	Reduced downside/upside exposure
	Digital options	Extreme payoff strategies

- Minimum variance hedge ratio for a cross-hedge
  - Obtained from a regression of change in value of underlying asset in domestic currency terms against change in value of the hedging security.
  - Beta (slope coefficient) of the regression equation is the optimal hedge ratio.
  - Basis risk occurs due to imperfect correlation between currency price movement and hedging instrument.

FIXED INCOME PORTFOLIO MANAGEMENT

INTRODUCTION

- Fixed-income returns model
  - Expected return decomposition

E(R) ≈ Yield income
+ Roll down return
+ E(Δ Price due to yields and spreads)
− E(Credit losses)
+ E(Currency gains and losses)

  - Yield income equals current yield assuming no reinvestment income

$$\text{Current yield} = \frac{\text{Annual coupon payment}}{\text{Bond price}}$$

  - Rolldown return: value change as bond approaches maturity (pull to par)

$$\text{Roll-down return} = \frac{B_1 - B_0}{B_0}$$

  - Expected price change due to change in yield or spread

$$E(\%\Delta P) = (-D_{Mod} \times \Delta Y) + (C \times 0.5\Delta Y^2)$$

  - Expected credit losses

$$E(\text{Credit losses}) = E(\text{Default rate}) \times E(\text{Losss severity})$$

- Effect of leverage on portfolio return

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

- Leverage with futures

$$\text{Leverage}_{\text{Futures}} = \frac{\text{Notional value} - \text{Margin}}{\text{Margin}}$$

LIABILITY-DRIVEN STRATEGIES

- Immunization: reduces or eliminates the risks to liability funding arising from interest rate volatility over the planning horizon.
- Immunizing a single liability
  - Market value of assets is greater than or equal to PV of liability
  - Macaulay duration of assets matches liability's due date
  - Convexity of asset portfolio is minimized.
  - Portfolio needs rebalancing as time passes.
  - Risk: non-parallel shifts in yield curve (risk is reduced by minimizing convexity).
- Cash flow matching for multiple liabilities
  - Portfolio has cash flows matching the amount and timing of liabilities.
- Duration matching for multiple liabilities
  - Market value of assets is greater than or equal to the market value of liabilities.
  - Asset basis point value (BPV) equals the liability BPV.
  - Dispersion of cash flows and convexity of assets are greater than those of the liabilities.
- Derivatives overlay
  - Uses bond futures contracts to immunize liabilities.

$$N_f = \frac{\text{Liability portfolio BPV} - \text{Asset portfolio BPV}}{\text{Futures BPV}}$$

$$\text{Futures BPV} \approx \frac{BPV_{CTD}}{CF_{CTD}}$$

- Contingent immunization
  - Active management if surplus (assets less liabilities) is above a designated threshold.
  - If the surplus falls below threshold, revert to a pure immunization strategy.
  - Use gains on actively managed funds to reduce cost of meeting liabilities.
- Horizon matching: cash flow matching for short-term liabilities (< 5 years), duration matching for long-term liabilities.
- Interest rate swap overlay to reduce duration gap

$$NP = \frac{\text{Liability portfolio BPV} - \text{Asset portfolio BPV}}{\text{Swap BPV}} \times 100$$

- Risks when managing portfolio against a liability structure: model risk, spread risk, counterparty credit risk.

INDEX-BASED STRATEGIES

- Total return mandates
  - Pure indexing (full replication): match benchmark weights and risk factors by owning all bonds in the index with the same weighting.

- Enhanced indexing: sampling approach to match primary risk factors; slight mismatch with benchmark weights to achieve a higher return compared to full replication.
- Active management: aggressive mismatches with benchmark weights and primary risk factors to achieve outperformance.

- Laddered bond portfolio
  - Maturities and par values spread evenly along the yield curve.
  - Protection from yield curve shifts and twists by balancing the position between cash flow reinvestment and market price volatility.
  - Suited to stable, upwardly sloped yield curve environments.
  - Higher convexity and liquidity.

YIELD CURVE STRATEGIES

- Stable yield curve strategies
  - Buy and hold: choose parts of curve where yield changes will not affect return or purchase longer-duration/higher-yield securities.
  - Rolldown: riding the yield curve when yield curve is upward-sloping.
  - Selling convexity: sell lower-yielding higher-convexity bonds if expecting low interest rate volatility.
  - Carry trade: buy longer-maturity, higher-yielding securities and finance them with shorter-maturity, lower-yielding securities.
- Changing yield curve strategies
  - Duration management: shorten (lengthen) duration if expect yield increases (decreases).
  - Buying convexity: with falling yields, portfolios with greater convexity will increase more in value than portfolios with less convexity; with rising yields, portfolios with greater convexity will decrease less.
  - Bullet and barbell structures

Relative Outperformance Given Scenario		
Yield Curve Scenarios		Structure
Level change	Parallel shift	Barbell
Slope change	Flattening	Barbell
	Steepening	Bullet
Curvature change	Less curvature	Bullet
	More curvature	Barbell
Volatility change	Decreased volatility	Bullet
	increased volatility	Barbell

- Duration management methods
  - Buy (sell) bond futures to increase (decrease) duration.

$$\#\ \text{Contracts required} = \text{VP}_{\text{X}}\frac{\text{PVBP}_{\text{T}} - \text{PVBP}_{\text{P}}}{\text{PVBP}_{\text{F}}}$$

where the subscripts on PVBP indicate the target value T, actual portfolio value P, and futures value F.

  - Use leverage to increase duration

$$V_{\text{Leveraged}} = \frac{\text{Additional PVBP}}{D_{\text{Modified}}\ \text{of bonds}} \times 10{,}000$$

$$D_{\text{New}} = D_{\text{Old}} \times \frac{V_{\text{Equity}} + V_{\text{Leveraged}}}{V_{\text{Equity}}}$$

  - Use interest rate swaps: receive-fixed, pay-floating swaps increase duration; pay-fixed, receive-floating swaps reduce duration.
- Convexity management methods
  - Shift bonds in portfolio (difficult with large portfolios).
  - Buying callable bonds and MBS (equivalent to selling convexity).
- Portfolio positioning strategy
  - Parallel upward shift: bonds with forward implied yield change greater than forecast yield change will enjoy higher return as they roll down the yield curve (upward sloping).
  - Parallel yield change of uncertain direction: increase convexity by using barbell strategy.

$$\begin{aligned} D_P &= w_S D_S + w_L D_L \\ &= w_S D_S + (1 - w_S) D_L \end{aligned}$$

where the subscripts indicate duration for the portfolio P, the short-maturity security S, and the long-maturity security L.

  - Using butterflies: long the wings (barbell) and short the body (bullet) if flattening curve, volatile interest rates, buying convexity or parallel yield curve increase; short the wings and long the body if steepening curve, stable interest rates or selling convexity.
  - Using options: sell convexity bonds (30-year maturity) and purchase call options to outperform in both rising and falling rate scenarios.

CREDIT STRATEGIES

- Risk considerations
  - High yield bonds: credit risk (includes default risk and loss severity).
  - Investment grade bonds: interest rate risk, credit migration risk, spread risk.
  - Spread duration (measure of spread risk): percentage increase in bond price for a 1% decrease in spread.
- Credit spread measures
  - G-spread: bond's yield to maturity less interpolated yield of correct maturity benchmark bond.
  - I-spread: uses swap rates rather government bond yields.
  - Z-spread: spread added to each yield-curve point so that PV of bond's cash flows equals price.
  - Option-adjusted spread (OAS) for bonds with embedded options: spread added to one-period forward rates that sets arbitrage-free value equal to price
- Excess return and expected excess return on credit securities

$$XR \approx (s \times t) - (\Delta s \times SD)$$

$$EXR \approx (s \times t) - (\Delta s \times SD) - (t \times p \times L)$$

- Bottom-up approach to credit strategy (security selection): for two issuers with similar credit risks, purchase bond with greater spread to benchmark rate.
- Top-down approach to credit strategy: macro approach to determine and overweight sectors with better relative value.
- Managing liquidity risk
  - Cash
  - Liquid, non-benchmark bonds (higher incremental return vs cash).
  - Credit default swaps index derivatives (more liquid than credit markets).
  - ETFs (liquid but unpredictable price movements in volatile markets).
- Tail risk
  - Assess tail risk by modelling unusual return patterns and using scenario analysis (historical and hypothetical).
  - Manage tail risk using (1) diversification strategies and (2) hedges using options and credit default swaps.
- Advantages of using structured financial securities such as ABSs, MBS, CDOs and covered bonds
  - Higher returns vs other types of bonds.
  - Improved portfolio diversification.
  - Different exposures to investment grade and high yield bonds.

TRADING, PERFORMANCE EVALUATION, AND MANAGER SELECTION

TRADING STRATEGY AND EXECUTION

- Trading strategy will be based on order characteristics, security characteristics, market conditions, user-based conditions, market impact, execution risk and trade benchmark
- Trading strategies include:
  - Short-term alpha
  - Long-term alpha
  - Risk rebalance trade
  - Cash flow-driven trade
- Trading algorithm classes include:
  - scheduled execution algorithms based on percentage of volume, colume weighted average price or time weighted average price
  - liquidity seeking algorithms that execute trades quickly across all available venues
  - arrival price strategies which look to trade as closes as possible to the market price at the time the order is received
  - dark strategies that use dark pools to trade in low liquidity or low urgency orders
  - smart order routers that find the best market price for the order across venues
- Implementaion shortfall (expanded):

$$\begin{aligned} IS &= \text{Delay costs} + \text{Trading costs} + \text{Opportunity costs} + \text{Fees} \\ &= \left[\left(\sum s_j\right) p_0 - \left(\sum s_j\right) P_d\right] + \left[\sum s_j p_j - \left(\sum s_j\right) p_0\right] \\ &\quad + \left(S - \sum s_j\right)(P_n - p_d) + \text{Fees} \end{aligned}$$

- Market-adjusted cost:

$$\begin{aligned} \text{Index cost (bps)} &= \text{Side} \times \frac{\text{Index VWAP} - \text{Index arrival price}}{\text{Index arrival price}} \times 10{,}000 \\ \text{Market-adjusted cost (bps)} &= \text{Arrival cost bps} - \beta \times \text{Index cost (bps)} \end{aligned}$$

PERFORMANCE EVALUATION

- Return attribution and risk attribution analyses the sources of return and risk respectively
- Macro and micro return attribution evaluates how decision of asset owners and portfolio managers respectively affect returns
- Attribution analysis may be returns-based (most common - using total returns only), holdings-based (using end of day data) or transactions-based (least common – using weights and returns of all transactions)
- Equity return attribution
  - Brinson-Hood-Beebower approach:

$$A = \sum_{i=1}^{n} (w_i - W_i) B_i$$

(Allocation effects – performance difference from the benchmark due to allocation decisions – Note: The Brinson-Fachler approach that is used for macro and micro attribution replaces B_i with $[B_i - B]$)

$$S = \sum_{i=1}^{n} W_i (R_i - B_i)$$

(Selection effects – performance difference from the benchmark due to manager selection decisions)

$$I = \sum_{i=1}^{n} (w_i - W_i)(R_i - B_i)$$

(Interaction effects – performance difference from the benchmark due to manager selection decisions)

S + I = Full selection effect

A + S + I = Portfolio excess return (alpha)

  - Factor-based return attribution

$$a_p = R_p - R_f - [\beta_{p1} RMRF + \beta_{p2} SMB + \beta_{p3} HML + \beta_{p4} WML + \varepsilon_p]$$

- Fixed-income return attribution
  - Exposure decomposition (duration based):

    Top down approach which compares portfolio duration and returns to that of the benchmark in order to understand which decisions (e.g. duration bets, sector allocation, bond selection) contribute to excess returns
  - Yield curve decomposition (duration based)

    Top down or bottom up approach that identifies

contributions to total return from changes in yield to maturity and which can be used to determine success of yield curve decisions based on yield curve components (e.g. yield, roll, shift, slope, curvature, spread)

- Yield curve decomposition (full repricing)

  Bottom up approach that reprices constituent bonds from zero-coupon curves.

- Risk attribution
  - Bottom up approach will look at each position's contribution to tracking risk (relative) or total risk (absolute)
  - Top down approach will look to attribute tracking risk to allocation and selection effects (relative) or at each factor's contribution to total risk and specific risk (absolute)
  - Factor-based approach will look at each factor's contribution to tracking risk and active specific risk (relative) or at each factor's contribution to total risk and specific risk (absolute)
- Asset-based benchmarks include absolute return benchmarks, broad market indices, style benchmarks, factor-based benchmarks, returns-based benchmarks, manager metrics and custom security-based benchmarks
- Alternative asset benchmark issues include the following:
  - Hedge funds will often use the risk-free rate plus a spread (absolute or relative) to account for respective strategy risks
  - Unlisted real estate and private equity indices will likely include assets that are not investable
  - Commodity investment benchmarking is not able to use market-weighting as futures values offset to zero
- Appraisal measures used in comparing portfolios include:
  - Sharpe ratio

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

  - Treynor ratio

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

  - Information ratio

$$IR_A = \frac{\bar{R}_A - \bar{R}_B}{\hat{\sigma}_{A-B}}$$

  - Appraisal ratio

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

Where:

$$\sigma^2_{\varepsilon P} = \sigma^2_R - \beta^2\left(\sigma^2_B\right)$$
$$\sigma_{\varepsilon P} = \sqrt{\sigma^2_{\varepsilon P}}$$

  - Sortino ratio

$$SR_D = \frac{E(r_P) - r_T}{\sigma_D};\ ex\ ante \text{ Sortino ratio}$$
$$SR_D = \frac{\bar{r}_P - \bar{r}_T}{\sigma_D};\ ex\ post \text{ Sortino ratio}$$

where:

$$\sigma_D = \left[\frac{\sum_{t=1}^{N} \min\left[0,(r_t - r_T)\right]^2}{N}\right]^{1/2}$$
$$r_T = \text{minimum acceptable return; target return}$$

  - Capture ratios

$$CR = \frac{UC}{DC}$$

Where:

$$\text{Capture} = \frac{R_t}{B_t}\begin{cases} UC \text{ if } B_t \geq 0 \\ DC \text{ if } B_t < 0 \end{cases}$$

INVESTMENT MANAGER SELECTION

- Type I error: Hiring/retaining a manager with no skill
  - Explicit cost
  - Measured
  - Obvious to investors
- Type II error: Not hiring/firing a manager with skill
  - Opportunity cost
  - Seldom measured
  - Not obvious to investors
- Quantitative metrics used to evaluate managers include analysis of style (returns-based or holdings-based), active share, up/down capture, and drawdowns
- Qualitative metrics used to evaluate managers include analysis of philosophy, personnel, decision-making process (idea generation and implementation; portfolio construction and monitoring), operations (trading process, firm characteristics), investment vehicle and terms, and fee structure

CASE STUDIES

INSTITUTIONAL INVESTOR: ILLIQUID INVESTMENTS, ETHICS AND DERIVATIVES

- Illiquidity premium is likely to be based on the illiquidity horizon. It might be calculated by way of put option costs or premiums offered by low-liquidity equities
- Illiquidity risk management tools include:
  - Liquidity profiling – classifying assets based on their level of liquidity and investing in line with a liquidity budget
  - Rebalancing strategies – managing asset allocation and transaction costs involved with rebalancing
  - Commitment strategies – managing capital calls
  - Stress testing – assessing liquidity under market stress
  - Derivatives – altering liquidity levels through use of highly liquid derivatives and associated leverage
- The manager selection process can raise ethical considerations between stakeholders (researcher, portfolio manager, external managers, end investors, etc) including Standard IV(A) Conflicts of Interest; Standard I(B) Independence and Objectivity, and Standard III(E) Preservation of Confidentiality
- The use of derivative overlays can raise important considerations between overlay types (ETFs, futures, and swaps) including trading costs, cash usage, liquidity, monitoring, and counterparty risk

PRIVATE WEALTH CLIENTS: ETHICS A

- Illiquidity premium is likely to be based on the illiquidity horizon. It might be calculated by way of put option costs or premiums offered by low-liquidity equities
- Illiquidity risk management tools include:
  - Liquidity profiling – classifying assets based on their level of liquidity and investing in line with a liquidity budget
  - Rebalancing strategies – managing asset allocation and transaction costs involved with rebalancing
  - Commitment strategies – managing capital calls
  - Stress testing – assessing liquidity under market stress
  - Derivatives – altering liquidity levels through use of highly liquid derivatives and associated leverage