

Study Session 13

Alternative Investments for Portfolio Management





KAPLAN
SCHWESER

Alternative Investments for Portfolio Management

- Alternative Investments Portfolio Management
- Swaps
- Commodity Forwards and Futures

Alternative Investments



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Alternative Investments for Portfolio Management

- Alternative Investments Portfolio Management

Alternative Investments

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Common Features of Alternative Investments

- **Low liquidity** – require a return premium
- **Diversification** potential – typically low correlations with traditional investments
- **High due diligence costs** – complexity, uniqueness, low transparency
- **Difficult appraisals** – benchmarking is a challenge
- **Informationally less efficient** than stock markets

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Role in a Portfolio

1. Exposure to **asset classes** that stocks and bonds cannot provide
2. Exposure to **special investment strategies** (e.g., hedge and venture capital funds)
 - Special strategies and unique asset classes (e.g., funds that invest in private equity and distressed securities)

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Seven Due Diligence Checkpoints

1. Assess the market opportunity offered
2. Assess the investment process
3. Assess the organization of the manager and his operations
4. Assess the people
5. Assess the terms and structure
6. Assess the service providers (i.e., lawyers, brokers, ancillary staff, etc.)
7. Review documents

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Due Diligence Special Concerns

- **Real estate (direct)**
 - Valuation methods deserve special attention
 - May be special zoning and legal issues
- **Private equity**
 - Performance evaluation/attribution
 - Internal operational processes
 - Financial/legal audit

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Due Diligence Special Concerns

- Hedge funds
 - Structure
 - Names and duties of managers and personnel, etc.
 - Strategy
 - Style, investments
 - Performance data

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Due Diligence Special Concerns

- Hedge funds (cont.)
 - Risk measures (e.g., use of leverage)
 - Research (e.g., the amount spent on it)
 - Administration (e.g., employee turnover)
 - Legal (e.g., lock-ups)
 - References (e.g., current investors, auditors, and legal counsel)

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Due Diligence Special Concerns

- **Managed futures**
 - Use of derivatives and leverage
 - Special emphasis on risk management
- **Distressed securities**
 - Business valuation, credit analysis, and assessing the company's problems and financial structure

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Special Issues for Private Wealth Clients

- **Tax issues:** Partnerships, trusts
- **Suitability:** Goals, time horizons, subjective concerns
- **Communication:** Is the client knowledgeable?
- **Decision risk:** Will the client want drastic changes in reaction to a loss?
- **Concentrated positions**
 - Watch for closely held equity outside the investment portfolio

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Alternative Investments Classes: Real Estate

- **Direct investment**
 - Residences
 - Commercial real estate
 - Land, etc.
- **Indirect real estate**
 - REITS
 - CREFs
 - Infrastructure funds

Explained →

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Alternative Investments Classes: Real Estate (cont.)

- **Direct investments** in real estate generally have low liquidity, large lot sizes, high transactions costs, low mobility, and asymmetric information in transactions
- Real estate provides **diversification** to a stock/bond portfolio, can have a large idiosyncratic risk component

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Alternative Investments Classes: Private Equity

- **Start-up or formative-stage** companies are those that are not yet or have just begun selling a product
- **Middle-market private companies** are established – may be preparing for an IPO
- **Private investment in public entities (PIPE)**
 - Purchasing or privatizing a public company, an established private company, or a division of an established company

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Alternative Investments Classes: Private Equity (Cont.)

- All categories have low liquidity
- **Direct investment** in private equity is when the investor purchases a claim directly from the firm
- **Indirect investment** is usually done through private equity funds

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Alternative Investments Classes: Commodities

- **Direct investment** is either through the purchase of the physical commodity or the purchase of derivatives on the commodity
- **Indirect investment** in commodities is usually done through investment in companies whose principal business is associated with a commodity

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Alternative Investments Classes: Commodities (Cont.)

- Investments are **fairly liquid**, especially when compared to many other alternative investments
- Investments in commodities have common risk features such as **low correlation** with stocks and bonds
- Some have positive correlation with **inflation**

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Alternative Investments Classes: Managed Futures

- Share many characteristics with **hedge funds**:
 - The primary legal structure of most managed futures in the United States is the **limited partnership**
 - Similar compensation scheme for managers (base fees plus performance fees)
 - Usually classified as **absolute return strategies**

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Alternative Investments Classes: Managed Futures (cont.)

- Hedge funds and managed futures funds hold **different assets**
 - **Managed futures**
 - Tend to trade in derivatives markets
 - Generally take positions based on broad market indices (i.e., macro focus)
 - **Hedge funds** tend to have a micro focus

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Alternative Investments Classes: Managed Futures (cont.)

- Risk characteristics vary
 - Trend-following strategy offers **lower diversification** than a contrarian strategy
 - **Standard deviation** of is generally less than equities, but greater than bonds
 - Low (even negative) **correlation** with equities
 - **Liquidity** is lower for private managed futures funds than for publicly traded funds

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Alternative Investments Classes: Buy-out Funds

- **Middle-market buyout funds**
 - Buy divisions spun off from larger, publicly traded firms and private companies that cannot efficiently obtain capital
- **Mega-cap buyout funds**
 - Take publicly traded firms private

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Alternative Investments Classes: Buy-out Funds

- Partners usually capture value through:
 - **Private placements**
 - **IPOs**
 - **Dividend recapitalizations**
 - Issue debt through the purchased firm and pay themselves a special dividend
 - Withdraw investment while retaining ownership/control

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Alternative Investments Classes: Infrastructure Funds

- Purchase public infrastructure assets
- Provide relatively quick, stable, long-term real returns
- Regulated by local governments
- Low correlation with equity markets, but lower returns because of lower risk

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Alternative Investments Classes: Distressed Securities

- Risk and return depend upon **skill-based strategies**
- Often considered to be part of the hedge fund class of alternative investments
- May also be part of the private equity class
- One way to classify subgroups in distressed securities is by structure
 - For example, hedge fund, private equity fund

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Alternative Investments Classes

	Types of Investments	Risk/Return Features	Liquidity
Real estate	Residences; commercial real estate; agricultural land.	Large idiosyncratic risk component; provides good diversification.	Low.
Private equity	Preferred shares of stock; venture capital; buyout funds.	More risk and lower returns than established companies.	Low.
Commodities	Agricultural products; crude oil; metals.	Low correlation with stocks/bonds. Positive correlation with inflation.	Fairly liquid. Continued →

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Alternative Investments Classes (cont.)			
	Types of Investments	Risk/Return Features	Liquidity
Managed futures	Tend to trade only in derivatives mkt. Private commodity pools; publicly traded commodity futures funds.	Risk is between that of equities and bonds. Negative and low correlation with equities and low to moderate correlation with bonds.	Lower for private funds than for publicly traded commodity futures funds.
Distressed securities	May be part of hedge fund class or private equity class. Investments can be in debt and/or equity.	Depends on skill-based strategies. Can earn higher returns due to legal complications and the fact that some investors cannot invest in them.	Hedge fund structure more liquid; private equity structure less liquid.

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Alternative Investment Benchmarks: Real Estate
<ul style="list-style-type: none"> ■ Direct real estate <ul style="list-style-type: none"> ■ National Council of Real Estate Investment Fiduciaries (NCREIF) Property Index ■ <i>Value-weighted</i> index of commercially owned properties ■ Values are usually by annual appraisal, so the volatility of the index is downward-biased

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Alternative Investment Benchmarks: Real Estate (Cont.)

- Indirect real estate
 - National Association of Real Estate Investment Trusts (NAREIT) Index
 - Cap-weighted
 - Includes all REITs traded on the NYSE or AMEX
 - “Live” (based on trade prices) so represents current values

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Alternative Investment Benchmarks: Private Equity

- Cambridge Associates and Thomson Venture Economics
- Since private equity values are not readily available, the value of a private equity index depends upon **events** like IPOs, mergers, new financing to provide market information
 - Benchmark value might be outdated

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Alternative Investment Benchmarks: Commodities

- Most represent futures-based strategies (i.e., passive long positions)
 - For example, Dow Jones-AIG Commodity Index (DJ-AIGCI) and S&P Commodity Index (S&PCI)
- Include exposures to most types of commodities and are considered **investable**
 - Two methods of weighting:
 1. World-wide production of commodity
 2. Perceived world-wide importance

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Alternative Investment Benchmarks: Managed futures

- Mount Lucas Management Index (MLMI)
 - Replicates the return to a mechanical, **trend-following strategy**
 - Long and short positions using rules based on technical rules

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Alternative Investment Benchmarks: Managed futures (Cont.)

- CTA Indices published by CISDM
 - Based on peer-group managed futures funds
 - Use dollar-weighted (CTA\$) and equal-weighted (CTAEQ) returns from databases of separately-managed accounts
 - Some are based on the level of discretionary management

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Alternative Investment Benchmarks: Distressed Securities

- Most of the index providers for hedge funds have a sub-index for distressed securities
- Generally have the same characteristics as long-only hedge fund benchmarks

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Alternative Investment Benchmarks: Hedge Funds

- Selection criteria vary by assets under management, length of track record, restrictions on new investment, etc.
- Either equal- or value-weighted
- Varied rebalancing rules
- Investability depends upon frequency of reporting
 - Some not investable
 - Some firms use an investable proxy

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Alternative Investment Benchmarks: Hedge Funds (Cont.)

- Some report included funds, some don't
- Biases due to self-reporting by fund returns include **backfill bias** (a.k.a. **inclusion bias**)
- Methods for selecting and weighting funds included in the index can cause a wide range of returns among indices in the same class
 - Equally weighted indices are not rebalanced often and effectively

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Alternative Investment Benchmarks: Hedge Funds (Cont.)

- **Popularity bias** can result if one of the funds in a value-weighted index increases in value and then attracts a great deal of capital
- **Survivorship bias** occurs as indices drop funds with poor track records or those that fail
 - Causes an upward bias in reported values

Summary table →

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Alternative Investment Benchmarks

	Benchmarks	Construction	Biases
Real estate	NCREIF; NAREIT	NCREIF is value-weighted; NAREIT is cap-weighted	Measured volatility is downward biased. Valued periodically (annually).
Private equity	Provided by Cambridge Associates and Thomson Venture Economics.	Constructed for buyout and venture capital. Value depends upon events. Often create custom benchmarks.	Re-pricing occurs infrequently which results in dated values. Continued →
Commodities	Dow Jones-AIG Community Index; S&P Commodity Index	Assume a futures-based strategy. Most types considered investable.	Indices vary widely with respect to purpose, composition, and method of weighting.

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Alt. Investment Benchmarks (Cont.)

	Benchmarks	Construction	Biases
Managed futures	MLMI; CTA Indices.	MLMI replicates the return to a trend-following strategy. CTA Indices use dollar-weighted or equal-weighted returns.	Requires special weighting scheme.
Distressed securities	Characteristics similar to long-only hedge fund benchmarks.	Weighting either equally-weighted or based upon assets under management. Selection criteria can vary.	Self-reporting; backfill or inclusion bias; popularity bias, survivorship bias.

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Return and Diversification Effects Real Estate

- High risk-adjusted performance is possible
- Often low correlations with stocks and bonds
 - Can react differently to changes in macroeconomic factors
- Regional markets might not be correlated
- Large **idiosyncratic risk** components
 - Individual investments can have very specific risk characteristics

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Return and Diversification Effects Private Equity

- Usually correlated with stocks and bonds
 - Reduced diversification potential
- **Usually illiquid**
 - Requires a long-term commitment
- Large **idiosyncratic risk** component

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Return and Diversification Effects Commodities

- **Correlations** with stocks and bonds typically low and even slightly negative
- Commodity indices have a strong **positive correlation with inflation** (except agricultural)
 - Returns and Sharpe ratios are generally lower than stocks and bonds
 - 2000 to 2004 returns beat stocks and bonds but still lower Sharpe ratio (high volatility)

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Return and Diversification Effects Hedge Funds

- From 1990 – 2004 hedge funds generated **higher absolute and risk-adjusted returns** than stocks and bonds
- For 2000 – 2004 mean return and Sharpe ratio **higher than stocks**
 - Sharpe ratio **lower than bonds**

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Return and Diversification Effects Managed Futures

- Usually considered a category of hedge funds
- 1990 – 2004 CTA\$ had return equivalent to stocks but slightly **better Sharpe ratio**
 - Higher return than bonds but **lower Sharpe ratio**
- Seem to provide unique returns and diversification benefits
 - ~0 correlation with 50/50 stock bond fund

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**Return and Diversification Effects
 Distressed Securities**

- Relatively high average return but large negative skew
- Many investors cannot hold distressed securities
 - Opportunities for high returns
- HFR Distressed Securities index outperformed stocks and bonds on absolute and risk-adjusted basis
- Mostly event-driven returns, so uncorrelated with the overall stock market

Summary Table →

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Return Enhancement and Diversification

Alternative Investment	Return Compared to 50/50 Stocks & Bonds	Potential for Diversification
Real estate	Similar	Good
Private equity	High	Low
Commodities	Low	Good
Managed futures	Similar	Moderate
Distressed securities	High	High
Hedge fund	Varies by type	Varies by type

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Return Enhancement and Diversification

Portfolio Returns over 1990-2004: 50/50 stocks and bonds compared to 40/40/20 stocks, bonds, and the indicated class (broad-based indexes used for classes)

Annual	50/50 Stocks & Bonds	20% REITs	20% real estate	20% commodities	20% hedge funds
Return	9.6%	10.3%	9.3%	9.5%	10.4%
Std Dev	7.9%	7.6%	6.6%	7.2%	7.1%
Sharpe	0.67	0.79	0.77	0.73	0.87

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Direct Real Estate Equity Investing

- Advantages
 - Tax-deductible expenses
 - High leverage capability
 - Direct control
 - Geographical diversification
 - Low return volatility

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Direct Real Estate Equity Investing

- **Disadvantages**
 - High unit costs – may be large portion of portfolio
 - High information, operating, and maintenance costs, high commissions, hands-on management requirement
 - Unique geographical risks
 - Political risks, neighborhood deterioration

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Venture Capital: 3 Stages

1. **Early Stage:** Pre-revenue period with three sub-stages
 - i. **Seed:** The initial small amount from the entrepreneur to get idea off the ground
 - ii. **Start-up:** A pre-revenue stage to bring the idea to commercialization
 - iii. **First stage:** Additional funds if idea is sound but funds have run out

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Venture Capital: 3 Stages

2. Later stage
 - After revenue has started
 - Supposed to help expand sales
3. Exit stage
 - Merger, acquisition, or IPO

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Venture Capital Issuers (Borrowers)

- Formative-stage companies
 - Either new or young
- Expansion-stage companies
 - Need funds to either expand revenues or prepare for an IPO

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Venture Capital Buyers

- **Angel investors**
 - The first outside investors after the family and friends of the founders
- **Venture capitalists**
 - Find good prospects and offer financial and strategic support
- **Large companies**
 - Engage in *corporate venturing* to become strategic partners

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Venture Capital vs. Buyout Funds

- **Buyout funds** purchase more developed entities and even established businesses, which usually means:
 - Less risk
 - A higher level of leverage is possible
 - Earlier and steadier cash flows
 - Less error in the measurement of returns
 - Less frequent losses
 - Less upside potential

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Convertible Preferred

- **Convertible preferred stock** is a good vehicle for direct venture capital investment
 - Preferred stockholders must be paid a specified amount before common stockholders can receive cash in the form of dividends or other distributions
 - Any buyout of the company that is favorable to shareholders will lead to the favorable conversion of the preferred stock

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Private Equity Funds

- Usually take the form of **limited partnerships** or **limited liability companies (LLC)**
 - For **limited partnerships**, the sponsor is called the *general partner*
 - For **LLCs** the sponsor is called the *managing director*
- The **timeline** starts with the sponsor getting commitments from investors at the beginning of the fund and then giving “capital calls”
- The expected life of these funds is **7 to 10 yrs**

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Sponsor Compensation

- **Sponsor** (a.k.a. venture capitalist, general partner, manager) earns return on invested capital
- Also gets a *management fee* and *incentive fee*
 - **Management fee** is usually 1.5% to 2.5% of *committed funds*, not funds already invested
 - **Incentive fee** (a.k.a. **carried interest**) is the manager's share of profits above hurdle rate
 - Can be paid on expectations but usually a "claw back" provision if expectations not met

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Issues in Private Equity Investing

- Because of **low liquidity**, the portfolio allocation to this class should typically be 5% or less with a plan to keep the money invested for seven to ten years
- Since individual commitments are usually large, only investors with sufficiently large portfolios are suitable to invest in the necessary five to ten investments needed for **diversification**

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Issues in Private Equity Investing (Cont.)

- **Diversification strategy**
 - Knowing how the unique aspects of a proposed private equity investment relate to the overall portfolio
- **Plans for meeting capital calls**
 - The committed funds are only called as needed

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Commodity Investing

- **Direct commodity investment** entails either purchasing the actual commodities or gaining exposure via derivatives
- **Indirect commodity investment** is the purchase of indirect claims like shares in a corporation that deals in the commodity

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Term Structure of Futures Prices

- The *spot return* (a.k.a. *price return*) is the change in the spot price
- The *collateral return* (a.k.a. *collateral yield*) is approximately the risk-free rate
- *Roll return* (a.k.a. *roll yield*) is the movement in the futures price that is not explained by movement in the spot price

$$\text{Roll return} = (\Delta \text{ futures price}) - (\Delta \text{ spot price})$$

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Term Structure of Futures Prices (Cont.)

- **Backwardation** produces a downward-sloping term structure of futures prices
 - Produces an expected **positive roll return**, as the futures price increases to the spot price
- If the term structure is positive, which is a result of **contango**, the roll return would be negative

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Futures Prices Term Structure (Cont.)

Total return = spot return + collateral return
 + roll return

Example:

The futures price changed by \$6, the spot return is \$3, and the collateral return is \$1. **Calculate** the roll return.

Answer:

Roll return = (Δ futures price) – (Δ spot price)
 = \$6 – \$3 = \$3

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Commodities and Inflation

- The returns of many types of commodities have a **positive correlation with inflation**, and thus, provide a hedge against inflation
 - Storable commodities
- The returns of some types of commodities have a **negative correlation with inflation**
 - Generally **agricultural** in nature and are not storable

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9 Hedge Fund Classifications

1. **Convertible arbitrage:** Positions in convertibles (e.g., bonds) with an offsetting position in the underlying common equity
2. **Distressed securities:** Speculation on low-grade bonds
3. **Emerging markets:** Long positions in developing markets
4. **Equity market neutral:** Exploit price discrepancies through long and short positions with the goal of no systematic risk

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9 Hedge Fund Classifications

5. **Fixed-income arbitrage:** Long and short positions based on expected yield curve changes
6. **Fund of funds:** 10–30 funds for diversification, but higher fees because of the second tier of management
7. **Global macro:** Focus on large areas by taking positions in major financial and non-financial markets

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9 Hedge Fund Classifications

8. **Hedged equity strategies:** Same as above *without* focus on canceling out systematic risk
9. **Merger arbitrage:** Buy target, short acquirer

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Alternative Style Classifications

- **Relative value strategies** attempt to exploit price discrepancies
- **Event driven strategies** invest with a short-term focus on an event like a merger or the turnaround of a distressed company
- **Equity hedge** entails taking long and short equity positions with varying overall net long or short positions

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Alternative Style Classifications

- **Global asset allocators** take long and short positions in a variety of both financial and non-financial assets
- **Short selling** takes short-only positions in the expectation of a decline in value

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Hedge Fund Structure

- The most common **compensation structure** of a hedge fund consists of an assets-under-management, or *AUM fee*, of about 1% to 2% and an *incentive fee* of 20% of “profits”
- A **high-water mark provision** is designed to prevent double payment to a manager for the same gains
- A **lock-up period** is a common provision in hedge funds

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Example: High water Mark

- **Example:** If a fund goes from \$100 to \$110, and the \$10 gain is all “profit,” the manager would get \$2 based on a 20% incentive fee. The \$110 would then be declared a high water mark
- The manager only gets paid additional incentive fees for gains beyond the high-water mark of \$110

Continued →

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Hedge Fund Incentive Fees

- **Incentive fees** are paid to encourage the manager to earn higher profits
- There is some controversy concerning incentive fees
 - Manager should have goals other than simply earning a gross return
 - For example, should provide limited downside risk, sufficient diversification

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Fund of Funds

- A **fund of funds (FOF)** is a hedge fund that consists of several, usually 10 to 30, hedge funds
- Often a FOF offers more liquidity for the investor, but the cost is cash drag caused by the manager keeping extra cash to meet potential withdrawals by other investors

Continued →

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Fund of Funds (Cont.)

- May serve as a better indicator of **aggregate performance of hedge funds** because they suffer from less survivorship bias
- A FOF can suffer from **style drift**
- FOF returns have been **more highly correlated with equity markets** than individual hedge fund returns

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Five Special Issues in Hedge Fund Evaluation

1. Absolute-return vehicles

- No direct benchmark
- Difficult to determine alpha
- Can use multifactor models to mimic

2. Conventions

- Funds with longer lock-up periods tend to outperform
- Younger and smaller funds tend to outperform

Continued →

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Five Special Issues in Hedge Fund Evaluation

3. Returns are affected by:

- Entry/exit of investors
- Frequency of manager's trading
- Monthly returns are annualized
 - Often use rolling 12-month returns

Continued →

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Five Special Issues in Hedge Fund Evaluation

4. Leverage

- For evaluation purposes, treat each asset as if it was “all cash”

5. Downside deviation (a.k.a. semi-variance)

- Managers should not be punished for upside returns
- Measure downside risk only

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Limitations of Using Sharpe Ratio to Measure Hedge Fund Performance

Sharpe ratio assumes:

- **Normality**
 - Standard deviation is not valid for skewed distributions (e.g., hedge funds)
- **Liquidity**
 - Missing returns produce downward bias in standard deviation
 - Upward bias in Sharpe ratio

Continued →

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Limitations of Using Sharpe Ratio to Measure Hedge Fund Performance (Cont.)

Sharpe ratio assumes/has:

- **Uncorrelated returns**
 - Autocorrelation produces downward bias in standard deviation → Sharpe ratio ↑
- **Time dependency**
 - Return and std. dev. are annualized
 - As holding period ↑ → Sharpe ratio ↑

Continued →
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Limitations of Using Sharpe Ratio to Measure Hedge Fund Performance (Cont.)

Sharpe ratio is:

- **Stand-alone measure**
 - Does not consider the diversification that hedge funds provide

In addition:

- Managers can manipulate the inputs
- Bad predictor of the future
 - Little power to predict hedge fund winners

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Derivative Market Impacts

- Derivatives are a **zero-sum game**
 - Gross long-term return on passively managed and unlevered portfolios should be the risk-free rate
- Actively managed funds try to earn excess returns by finding cases where pricing relationships are not in equilibrium or by following momentum strategies

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Distressed Securities Investing

- **Long-only value investing**
 - Find opportunities where the prospects will improve before other investors find them
- **High-yield investing**
 - Publicly traded, below-investment grade debt
- **Orphan equities investing**
 - Equities of firms emerging from reorganization

Continued →

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Distressed Securities Investing (Cont.)

- **Distressed debt arbitrage** can earn a return in two ways. If the firm's condition:
 1. **Declines**, the debt and equity will both fall in value, but the equity should decline more in value because debt has seniority
 2. **Improves** (because of the priority of interest over dividends) the returns to bondholders should be greater than that of equity holders, including dividends paid on the short position

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Distressed Securities: Special Risks

- **Event risk:** Return often depends on a particular company event, which can be good because that increases diversification
- **Market liquidity risk:** Low liquidity and cyclical supply and demand
- **J factor risk:** The “human factor” that courts and judges introduce
- **Market risk:** Impact of macroeconomic changes (usually a lower concern than the other risks)

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Alternative Investments for Portfolio Management

• Swaps

Alternative Investments

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Swaps

Commodity Swaps: Review

- Two parties agree to pay/receive the difference between a fixed price and the market price times a given amount or **notional principal** (NP) of the commodity
- The swap price is computed like the fixed-rate of an interest-rate swap
 - **Price (rate)** is weighted average of forward prices (rates)
 - Weighted by the forward discount factors (FDFs) computed from the forward rates

Continued →

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Commodity Swaps: Review (Cont.)

$$\text{swap rate} = \frac{\sum_1^T \text{FDF}_t \times (\text{forward rate})_t}{\sum_1^T \text{FDF}_t}$$

$$\text{swap price} = \frac{\sum_1^T \text{FDF}_t \times (\text{forward price of commodity})_t}{\sum_1^T \text{FDF}_t}$$

Continued →
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Commodity Swaps: Review (Cont.)

- An example of a commodity swap is when a refinery enters into a commodity swap agreeing to pay the swap price of oil (the fixed value), and receive the market price of oil
- If the price of oil **increases**, the refinery will receive a payment equal to the difference in the market price and fixed value, times a notional principal (amount of oil)
- If the market price of oil **decreases**, the refinery will make a payment to its counterparty

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Swaps

Commodity vs. Interest Rate Swaps

- Commodity swaps settle in the same way as interest rate swaps
- **Interest-rate** swap payment at reset:
 - Payment made by **fixed-rate** payer =
(fixed rate – floating rate) × (nominal NP)
- **Commodity** swap payment at reset:
 - Payment made by **fixed-price** payer =
(fixed price – market price) × (quantity NP)

Continued →

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Swaps

Commodity vs. Interest Rate Swaps (Cont.)

Swap Valuations

- Both interest rate and commodity swap values:
 - Equal the **PV of the cash flows** locked in by taking offsetting positions in forward contracts
 - **Equal zero** at inception
 - **Change** with market rates and, in the case of the commodity, prices change
 - **Change over time** even if the market rates and prices do not change

Continued →

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LOS 37 CFAI Vol. 5 P. 142 Swaps

Commodity vs. Interest Rate Swaps (Cont.)

- A **commodity swap** can incorporate **seasonal properties** for both the fixed price and NP
 - Fixed price and/or NP can be cyclical each year
 - For example, a swap on oil with semi-annual reset has a higher price and/or NP in the winter than the summer

Continued →

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LOS 37 CFAI Vol. 5 P. 142 Swaps

Commodity vs. Interest Rate Swaps (Cont.)

- An **interest rate swap** can have **changing notional principal (NP)**
 - Amortizing swap
 - NP **declines** over life of swap
 - Accreting swaps
 - NP **increases** over life of swap

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Swaps

Swap Risk Exposures

- From the perspective of the **buyer** of a **prepaid swap** (commodity swap) there are three types of risks:
 1. **Credit risk** (default risk)
 - Less for financially-settled swaps
 2. **Market risk** (adverse market movements)
 3. **Financial risk** (increased interest rates)

Continued →

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Swaps

Swap Risk Exposures (Cont.)

- Commodity swaps have risk from both **changing prices** and **changing interest rates**
- Investor needs to **hedge**:
 - **Price risk** with **commodity futures**
 - **Interest rate risk** with **interest rate futures**, **interest rate swap**

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Alternative Investments for Portfolio Management

- **Commodity Forwards and Futures**

Alternative Investments

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Commodity Forward Prices

- Assuming there are no costs or rewards associated with holding a commodity, its forward price should be:

$$F_{0,T} = (S_0)e^{(R_F)T}$$

- We will look at the effects of incorporating three factors into commodity forward prices:
 1. Storage costs
 2. Convenience yield
 3. Lease rates

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Commodity Forwards and Futures

Commodity Storage Costs, λ

- To agree to sell a commodity forward, the owner of the commodity must be compensated for any physical and financial (i.e., interest) storage costs
- The owner will only store the commodity, if the forward price is greater than or equal to the spot price plus **storage costs**

$$F_{0,T} = (S_0)e^{(R_F + \lambda)T}$$

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Commodity Forwards and Futures

Commodity Convenience Yield, c

- If owners of the commodity need the commodity for their business, simply holding a physical inventory of the commodity is valuable
- Holding an amount of a commodity for a non-monetary return is referred to as **convenience yield**

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Commodity Convenience Yield, c

- Value received from holding a commodity will reduce the forward price at which the owner will agree to sell the commodity.

$$F_{0,T} = (S_0) e^{(R_F - c)T}$$

where :

c = convenience yield from holding the commodity

Pricing Summary →

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Commodity Lease Rate, δ

- A lease rate is the amount of interest the lender of a commodity requires
 - The rate of return the investor requires to buy and then lend the commodity

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Commodity Forwards and Futures

Commodity Lease Rate, δ

- The lease rate represents a gain from owning the commodity and will thus reduce the forward price:

$$F_{0,T} = (S_0) e^{(R_F - \delta_1)T}$$

where:

 δ_1 = the lease rate;

Must compensate the owner for the lost convenience yield from holding the commodity minus the costs of storing it ($\delta_1 = c - \lambda$)

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Commodity Forwards and Futures

Commodity Forward Pricing

Commodity pricing with lease rates, convenience yield, and storage costs:

Continued →

$F_{0,T} = (S_0) e^{(R_F)T}$	No costs or benefits
$= (S_0) e^{(R_F - \delta_1)T}$	With lease market
$= (S_0) e^{(R_F + \lambda)T}$	With storage costs
$= (S_0) e^{(R_F - c)T}$	With convenience yield
$= (S_0) e^{(R_F + \lambda - c)T}$	With all three

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Commodity Forward Pricing (Cont.)

- With **contango** the lease rate is **less** than the risk-free rate:

$$(R_F - \delta_1) > 0 : F_{0,T} = (S_0) e^{(R_F - \delta_1)T} \Rightarrow F_{0,T} > S_0$$

- With **backwardation** the lease rate is **greater** than the risk-free rate:

$$(R_F - \delta_1) < 0 : F_{0,T} = (S_0) e^{(R_F - \delta_1)T} \Rightarrow F_{0,T} < S_0$$

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Special Arbitrage Situations

- Not everyone can realize a convenience yield, so there is a **range** of possible no-arbitrage forward prices
 - The **upper bound** depends on storage costs but not on the convenience yield
 - The **lower bound** adjusts for the convenience yield

$$\underbrace{(S_0) e^{(R_F + \lambda - c)T}}_{\text{Lower bound}} \leq F_{0,T} \leq \underbrace{(S_0) e^{(R_F + \lambda)T}}_{\text{Upper bound}}$$

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LOS 38.a CFAI Vol. 5 P. 172 Commodity Forwards and Futures

Commodity Characteristics

- Certain commodities exhibit unique properties that impact their forward prices
- Commodities characteristics differ with respect to storage costs, the ability to store, production costs, and seasonal demand
- These differences are reflected in **lease rates**, **storage costs**, and **convenience yields** that influence the commodity forward prices and the shape of the **forward curves**

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Differences in Forward Commodity Prices

- **Gold**
 - The present value of gold received in the future is the present value of the forward price computed at the risk-free rate
- **Corn**
 - The forward curve is increasing until harvest and then drops sharply at harvest and slopes upward again after harvest

Continued →

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Differences in Forward Commodity Prices (Cont.)

- Natural gas
 - Storage is at its peak in the Fall just prior to the peak demand
 - Therefore, the forward curve rises steadily in the Fall

Continued →
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LOS 38.a CFAI Vol. 5 P. 172 Commodity Forwards and Futures

Differences in Forward Commodity Prices (Cont.)

- Oil forwards
 - Lower transportation costs and more constant worldwide demand causes the long-run forward price to be more stable
 - In the short run, supply and demand shocks cause more volatile prices, because supply is fixed

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LOS 38.b CFAI Vol. 5 P. 184

Commodity Forwards and Futures

Special Arbitrage Situations

- A **commodity spread** results from a commodity that is an input in the production process of other commodities
- **Example**
 - Soybeans are used in the production of soybean meal and soybean oil
 - A trader can create a **crush spread** by holding a long (short) position in soybeans and a short (long) position in soybean meal and soybean oil

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LOS 38.c CFAI Vol. 5 P. 198

Commodity Forwards and Futures

Financial vs. Commodity Futures: Basis Risk

- **Basis risk** results from the inability of futures contracts to represent a perfect hedge
- In order to minimize basis risk, a **futures contract** should be highly correlated with the price of the hedged asset with matched timing of delivery
- Basis risk in **commodity futures** depends on grade, storage costs, and/or transportation costs

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Alternative Investments for Portfolio Management

Sample Questions and Problems

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Sample Questions and Problems

Question 1*

- Platinum supplies expected to fall and spot prices to rise.
- Interest rates will rise.
- The convenience yield on platinum will increase.

* Based on Question 8 of the 2009 Level 3 CFA exam

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Sample Questions and Problems

Question 1

- A. **Determine** whether an increase, a decrease, or no change in *each* of the following return components should be expected:
- i. spot return (price return)
 - ii. collateral return (collateral yield)
 - iii. roll return (roll yield)

Justify *each* response with *one* reason.

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Sample Questions and Problems

Question 1.A

i. spot return (price return)	Increase	
	Decrease	
	No change	

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Sample Questions and Problems

Question 1.A

ii. collateral return (yield)	Increase Decrease No change	
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Sample Questions and Problems

Question 1.A

iii. roll return	
------------------	--

iii continued →

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Sample Questions and Problems

Question 1.A

iii. roll return	Increase	
	Decrease	
	No change	

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Sample Questions and Problems

Question 1 (Cont.)

- A company owns a 4-year 120,000,000 U.S. dollars (USD), 6% fixed rate, semi-annual bond.
- They want to protect against rising interest rates.
- Want to reduce the modified duration of this position from 3 to 0.3 with an interest rate swap
- Want NP as close to USD 120,000,000 as possible
- Four possible swaps (next slide)
 - Modified duration of the fixed rate component of a swap is 75% of its maturity.

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Sample Questions and Problems			
Available Swaps			
Swap	Type	Term	Payment Frequency
1	Pay fixed / receive floating	2 years	Semi-annually
2	Pay floating / receive fixed	4 years	Quarterly
3	Pay fixed / receive floating	4 years	Quarterly
4	Pay floating / receive fixed	2 years	Semi-annually

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Sample Questions and Problems
<h2>Question 1</h2> <p>B. Determine which swap <i>best</i> achieves the stated goals. Justify your response with <i>two</i> reasons.</p>

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Sample Questions and Problems

Question 1.B

Swap 1	1.
Swap 2	2.
Swap 3	
Swap 4	

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Sample Questions and Problems

Notional Principal Calculations

Swap 1:

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Notional Principal Calculations

Swap 3:

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Question 1.B

Conclusion

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Sample Questions and Problems

Question 2*

- The spot price for copper is 316 cents/lb, and the 3-month forward contract price is 313 cents/lb.
- A manager decides to implement a reverse cash-and-carry arbitrage to profit from the difference between the spot and forward prices.

* Based on Question 6 of the 2008 Level 3 CFA exam

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Sample Questions and Problems

Question 2

- A. **Describe** the two components of the synthetic commodity position in this arbitrage.

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Sample Questions and Problems

Question 2.A

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Question 2

B. Compute the profit on the reverse cash-and-carry arbitrage in part A.

Assume (continuous rates):

- Borrowing or lending cash at 5%
- The lease rate for copper is 6%

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Sample Questions and Problems

Question 2.B

Continued →
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Sample Questions and Problems

Question 2.B

Continued →
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Question 2.B

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Sample Questions and Problems

Question 2.B

Profit calculation:

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Sample Questions and Problems

Question 2

C. Explain how a higher convenience yield for copper would affect the no-arbitrage price range for the forward price.

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Sample Questions and Problems

Question 2.C

Continued →
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Question 2.C

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Portfolio Management**

**Sample Questions and Problems
Answers**

Alternative Investments

SS#13 – Alternative Investments for Portfolio Management **Answers**

Question 1.A

i. spot return (price return)	<input checked="" type="radio"/> Increase <input type="radio"/> Decrease <input type="radio"/> No change	<p>This is the return related to changes in the underlying commodity (platinum) using the cost-of-carry model. Smith expects the spot price of platinum to rise which would cause short-dated futures prices to rise as arbitrage trading occurred.</p>
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SS#13 – Alternative Investments for Portfolio Management **Answers**

Question 1.A

ii. collateral return (yield)	<input checked="" type="radio"/> Increase <input type="radio"/> Decrease <input type="radio"/> No change	<p>This is the return that arises from investment in platinum futures rather than the physical platinum. Smith is able to invest the full value of the underlying contract to earn the risk-free interest rate. Since he expects interest rates to rise, this component of return will also rise.</p>
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SS#13 – Alternative Investments for Portfolio Management **Answers**

Question 1.A

iii. roll return	Roll return is the return that arises from rolling long platinum futures contracts over time. Smith expects convenience yields will rise, increasing roll return as a result of increased backwardation. Also, he expects interest rates will rise, thus decreasing roll return.
------------------	--

iii continued →

SS#13 – Alternative Investments for Portfolio Management **Answers**

Question 1.A

iii. roll return	Increase Decrease No change	In the cost-of-carry model, these two factors have opposite effects. If these effects are assumed to offset each other, then there will be net change in the roll return. Conversely, if the rise in convenience yield is more than the rise in interest rates, roll return will increase.
------------------	--	--

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Answers

Question 1.B

Swap 1	1. To reduce duration the swap needs to pay fixed, receive floating...eliminates 2 & 4.
Swap 2	2. Swap 3 will have a duration of approximately -2.9 and a notional principal of approximately USD 113 million (USD 259 million for Swap1). (See NP calculations next two slides)
Swap 3	
Swap 4	

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Answers

Notional Principal Calculations

Swap 1: A 2-year pay-fixed, receive floating swap with semi-annual payments will have a duration of approximately:

$$(1/2) / 2 - 0.75(2) = 0.25 - 1.5 = -1.25$$

The required overall duration is 0.3 so the required notional principal (NP) would be :

$$120,000,000(3) + NP(-1.25) = 120,000,000(0.3)$$

$$NP = [120,000,000(3 - 0.3)] / 1.25 = 259,200,000$$

(more than double the 120,000,000 desired)

SS#13 – Alternative Investments for Portfolio Management

Answers

Notional Principal Calculations

Swap 3: A 4-year pay-fixed, receive floating swap with quarterly payments will have a duration of approximately:

$$(1/4 / 2) - 0.75(4) = 0.125 - 3.0 = -2.875.$$

The required overall duration is 0.3 so the required notional principal (NP) would be:

$$120,000,000(3) + NP(-2.875) = 120,000,000(0.3)$$

$$NP = [120,000,000(3-0.3)] / 2.875 = 112,695,652$$

(close to desired amount)

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Answers

Question 1.BConclusion

Swaps 2 and 4 increase duration and are therefore not appropriate.

Swaps 1 and 3 both decrease duration. Want notional principal to be as close as possible to the amount of the original bond. Therefore Swap 3, the 4-year quarterly, pay fixed, receive floating swap, is the appropriate swap.

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Answers

Question 2.A

For a reverse cash-and-carry arbitrage:

- Short copper in the spot market
- Establish a synthetic long position in the copper forward market consisting of:
 1. A long position in the forward contract that expires in three months
 2. Zero-coupon bonds with a maturity date identical to the forward expiration date, and face value equal to the forward price at maturity

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Answers

Question 2.B

Three transactions in the reverse cash and carry:

1. Go long the forward contract at 313 cents:
 - No initial cost with purchase of the contract
 - Payment of 313 cents/lb in 3 months, though

SS#13 – Alternative Investments for Portfolio Management **Answers**

Question 2.B

2. Short copper in spot market.

- Receive 316 cents/lb now
- Cover the short position in 3 months (with the copper from forward contract)
- Make lease payment in 3 months.
 - Lease rate is 6%; contract maturity 3 months
 - Lease payment is 4.78 cents/lb
 $(316e^{(0.06)(3/12)} - 316)$

SS#13 – Alternative Investments for Portfolio Management **Answers**

Question 2.B

3. Lend the proceeds of the short sale (316 cents) for 3 months at a yield of 5%.

- At maturity, the proceeds of loan will be 319.97 cents/lb (= $316e^{(0.05)(3/12)}$).

Profit calculation →

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Answers

Question 2.B

The profit associated with the reverse cash-and-carry arbitrage is 2.19 cents/lb:

Transaction	Cash Flows	
	Time 0	Time T = 3/12
Long forward contract	0	-313 cents/lb
Short sell copper	316 cents/lb	—————
Pay lease rate = 6%	—————	-4.78 cents/lb
Lend SS proceeds @ 5%	-316 cents/lb	319.97 cents/lb
Total	0	2.19 cents/lb

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Answers

Question 2.C

The no-arbitrage **range** for the forward price is:

$$S_0 e^{(r + \lambda - c)T} \leq F_{0,T} \leq S_0 e^{(r + \lambda)T}$$

- S_0 = spot price of the asset
- r = the continuously compounded interest rate
- T = time until expiration of the forward contract
- $F_{0,T}$ = today's price of a forward contract that matures at time T
- λ = storage cost
- c = **convenience yield**

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Answers

Question 2.C

- The *convenience yield* is the benefit from physical ownership and it affects the cost of short-selling
 - An arbitrageur who wants to short spot copper would need to compensate the lender of copper for the loss of the convenience yield
- A **higher** convenience yield will increase the cost of shorting spot copper and decrease the lower bound of the no-arbitrage range for the forward contract
- The upper bound is unaffected, resulting in a **wider** no-arbitrage price range