

L3 Primer

A REVIEW OF L1 & L2 ESSENTIALS

Level III CFA

Code of Ethics

1. Act with integrity, competence, diligence, and respect with the public, clients, employers, employees, and others.
2. Place the integrity of the investment profession and interests of clients above their own personal interests.
3. Use reasonable care and exercise independent professional judgment when conducting investment analysis, making recommendations, taking actions, and engaging in other activities.
4. Practice and encourage others to practice in a professional and ethical manner.
5. Promote the integrity of and uphold the rules governing capital markets.
6. Maintain and improve their professional competence and strive for the competence of other investment professionals.

Standards of Professional Conduct

There are seven Standards, within which there are a total of 22 sub-standards

Standard 1: Professionalism

STANDARD SUMMARY	GUIDANCE	RECOMMENDED PROCEDURES
1A: Knowledge of the law: Member must comply with all laws, comply with the stricter law and dissociate from any violation	• Follow all laws • Follow stricter of local law and CFAI Standards • If member suspects illegal activity he must: ✓ Report to Supervisor ✓ Disassociate from activity • May confront wrongdoer	• Keep informed, maintain files • Seek legal advice when in doubt • Encourage firms to adopt code of ethics • Distribute information internally on applicable laws • Have written procedures for reporting suspected violations
1B: Independence and Objectivity • Use reasonable care, judgment to achieve, maintain independence in professional activities • Do not offer, solicit, accept any compensation that could compromise independence, objectivity	• Modest gifts okay • Distinguish between gifts from clients and gifts from entities trying to influence • May accept gift from clients – must disclose to employer – must get permission if gift is for future performance • Investment banking relationships – do not bow to pressure • Firewalls between IB and research • For issuer paid research, flat fee preferred	• Create a restricted list; only factual info on companies • Restrict special cost arrangements • Limit gifts- token items OK • Restrict staff investments in IPO + private placements
1C: Misrepresentation Do not make misrepresentations relating to investment analysis, recommendations,	• Do not misrepresent qualifications, services of self or firm, performance record, or characteristics of an investment	• Firms should provide written list of services and a description of the firm's qualifications • Maintain records of materials used to prepare research reports, and quote source, except for

actions, or other professional activities	- Do not guarantee a certain return - No plagiarism (copying without giving credit)	“recognized financial and statistical reporting services
1D Misconduct: Do not engage in any professional conduct involving dishonesty, fraud, deceit, or commit any act that reflects adversely on professional reputation, integrity, or competence	- Covers conduct that may not be illegal, but could adversely affect a member’s ability to perform duties - Do not abuse the CFAI’s PCP to settle personal or political disputes	- Adopt code of ethics to which every employee must adhere to - Disseminate list of potential violations and associated disciplinary sanctions - Background checks on potential employees

Standard 2: Integrity of capital markets

STANDARD	GUIDANCE	RECOMMENDED PROCEDURES
2A Material non-public information: Members in possession of nonpublic information that could affect an investment’s value must not act or cause someone else to act on the information	- Material – if investors would want the information before making an investment decision - If price effect ambiguous, information not material “Non public”- Information not made available to investors in general/the market (not just analysts) Mosaic Theory – No violation when an analyst reaches an investment conclusion through analysis of public information, together with non-material nonpublic information	- Firewall to control interdepartmental communications - Review employee trades - Increase review of or restrict proprietary trading while firm is in possession of material nonpublic information
2B Market Manipulation: Do not engage in practices that distort prices or artificially inflate trading volume with intent to mislead market participants	- Do not give false impression of activity/price movement; - Do not distribute false, misleading information	

Standard 3: Duties to Clients

STANDARD	GUIDANCE	RECOMMENDED PROCEDURES
3A Loyalty, Prudence and Care: - Duty of loyalty to clients – act with reasonable care and exercise prudent judgment - Act for benefit of clients and place their interests before employer's or own interests - Comply with any applicable fiduciary duty	- Manage client assets according to IPS - Make investment decisions in context of total portfolio - Vote proxies responsibly. - Disclose proxy voting policies to clients "Soft dollars" must benefit the client	- Set the investment objectives of client - Diversify - Disclose conflicts - Vote proxies in best interest of clients and ultimate beneficiaries - Submit at least quarterly statements of account to client - Maintain confidentiality - Seek best execution - Always place client interest first
3B: Fair dealing Deal fairly, objectively with all clients when providing investment analysis, making investment recommendations, taking investment action or engaging in other professional activities	- No discrimination against any clients - Fair" does not mean "equal" - Different levels of service okay as long as disclosed, and does not disadvantage any clients - If client is unaware of recommendation change, advise before accepting trade order - Treat clients fairly considering IPS& circumstances - Disclose allocation procedures "Hot issues" for clients only	- Limit number of people aware of upcoming changes - Shorten time frame – decision to dissemination - Simultaneous dissemination - Maintain list of clients and holdings - Disclose trade allocation procedures - Client account review
3C: Suitability When in advisory relationship with a client: - Enquire into client's investment experience, objectives, constraints AND ensure investment is suitable as per these before making any recommendation/ taking investment action - Update information regularly - Look at suitability in a portfolio context When	- Only for advisory relationships - In cases of unsolicited trade requests that a member knows is unsuitable for the client, the member should refrain from making the trade or seek an affirmative statement from the client that suitability is not a consideration. - If clients withhold information about their portfolio, the suitability	Consider: - Objectives (risk and return) - Constraints (Time horizon, liquidity, tax, legal and unique circumstances) - Investor's circumstances periodically to reelect both the above - Performance benchmarks

managing a portfolio to a mandate/strategy/style, only make recommendations/ take investment actions that are consistent with portfolio objectives and constraints	analysis must be done on the information provided • No responsibility in case of managing pooled assets to enquire into suitability for individual investors • Prepare an IPS at the beginning of relationship	
3D Performance Presentation: When communicating investment performance, ensure that it is fair, accurate, and complete	• Do not misstate performance or mislead clients • Do not misrepresent past performance • Provide fair and complete information • Do not state or imply ability to achieve returns similar to those achieved in the past	• Consider audience sophistication • Use performance of the weighted composite of similar portfolios • Include terminated accounts as part of historical performance
3E Preservation of confidentiality: Keep information about current, former and prospective clients confidential unless: • Illegal activities are suspected • Disclosure is required by law OR • Client/prospect allows disclosure	• May provide confidential information about a client to CFA Institute for an investigation under the PCP into their own conduct • If applicable law requires members to maintain confidentiality, even if the information concerns illegal activities on the part of the client, members should not disclose such information	• Avoid discussing client information except to colleagues working on same project • If violation is suspected, notify supervisor. If this fails, seek legal advice and disassociate

Standard 4: Duties to Employers

STANDARD	GUIDANCE	RECOMMENDED PROCEDURES
4A Loyalty: Act for benefit of employer and do not deprive employer of the advantage of skills/abilities, divulge confidential information, or otherwise cause harm to employer	Independent practice • Competition with employer • Notify employer of services, duration, and compensation • Do not proceed without consent from employer Leaving an employer • Don't solicit employer's clients before leaving • Do not take records or files without permission • Simple knowledge of names of clients is okay Whistleblowing: • Only if it protects client or integrity of capital markets • Have to comply even if an independent contractor	
4B: Additional compensation arrangements Do not accept gifts, benefits, compensation, consideration that competes with, or creates a conflict of interest with employer's interest unless written consent is obtained from all parties involved	• Covers direct compensation by the client and other benefits received from third parties • For written consent email is acceptable	• Make written report to employer specifying details of additional compensation • Include nature of compensation, amount, and duration of agreement
4C Responsibilities of Supervisors: Detect and prevent violations of applicable laws, rules, regulations, and Code and Standards by anyone subject to your supervision or authority	• Take steps to prevent employees from violating laws, rules, regulations, or the Code and Standards • Detect violations • If the member cannot discharge supervisory responsibilities because of absence/inadequacy of a compliance system, the member should decline in writing to accept supervisory responsibility until the firm adopts procedures to allow them to exercise such responsibility	Compliance procedures should: • Be clear and understandable • Designate a compliance officer • List permitted conduct • Have procedures for reporting violations Supervisor and compliance officer should: • Distribute procedures, • Continually educate staff • Review employee actions Once violation has occurred: • Respond promptly • Conduct an investigation • Place limitations on the wrongdoer till investigation is complete

Standard 5: Investment Analysis, Recommendations, and Actions

STANDARD	GUIDANCE	RECOMMENDED PROCEDURES
5A Diligence and Reasonable Basis: - Exercise diligence, independence, thoroughness in analyzing investments etc. - Have a reasonable and adequate basis, supported by research, for analysis, recommendation, or action	Using third-party research: - Review assumptions, rigor, timeliness, and independence Group research and decision making: - If there is reasonable basis for opinion, member does not have to disassociate but should document the difference of opinion	- Review/approve research reports and recommendations prior to external circulation - Develop measurable criteria for assessing the quality of the research
5B Communication with clients and prospective clients Disclose: - Principles/processes used to select securities and construct portfolios - Material changes to these processes - Factors important (to analyses, recommendations, or actions) to clients Distinguish between fact and opinion	- Include basic characteristics of the security - Suitability of investment – portfolio context - All communication covered, not just reports - Brief communications must be supported by background data that can be made available to interested parties on request	- Maintain records showing nature of research - Give additional information if requested by client
5C Record Retention: Maintain records to support investment analyses, recommendations, actions, and other investment-related communications with clients and prospective clients	- Records are firm's property and cannot be taken without firm's consent - If no regulatory requirement, CFA Institute recommends retention period of 7 years - Hard copy or electronic form	Responsibility to maintain records generally falls with the firm

Standard 6: Conflicts of interest

STANDARD	GUIDANCE	RECOMMENDED PROCEDURES
6A Disclosure of conflicts: Make full, fair disclosure of all matters that could be expected to impair independence/objectivity, or interfere with duties to clients, prospects, or employer	Disclose to clients - Ownership of stock - Board service - Broker/dealer/market making activities - Investment banking relationships	- Disclose compensation arrangements with employer that conflict with clients' interests - If firm does not permit disclosure, consider dissociating from the activity

		- Firms are encouraged to include compensation information in promotional materials - Disclose details of options given as compensation for CF activities
6B Priority of Transactions: Investment transactions for clients and employers must have priority over investment transactions in which a Member is the beneficial owner	"Beneficial owner" – Member has direct/indirect personal interest in the securities - Client, employer transactions take priority over personal transactions - Family member accounts that are client accounts must be treated at par with other client accounts	- Limit participation in equity IPOs - Restrict employee investment in private placements - Establish blackout periods – no "front-running" - Employees should report trades, disclose holdings and get prior clearance - Disclose policies on personal investing to clients, upon request
6C Referral Fees Disclose to employer, clients, and prospective clients any benefit received by, or paid to, others for the recommendation of products or services	- Disclosure to be made before entering into any agreement for services - Disclose nature of the consideration - All types of compensation covered (cash/kind)	

Standard 7: Responsibilities as a CFA Institute member or CFA candidate

STANDARD	GUIDANCE	RECOMMENDED PROCEDURES
7A: Conduct as Members and Candidates in CFA Program: Do not engage in any conduct that compromises the reputation or integrity of CFA Institute or CFA designation, or the integrity, validity, or security of the CFA examinations	Conduct includes: - Cheating on the exam - Disregarding exam admin rules - Giving confidential information to candidates or public - Using association with CFAI to further personal or professional objectives - Misrepresenting on PCS or the CFA Institute PCP	Read the exam guidelines carefully

7B Reference to CFA Institute, the CFA Designation, and the CFA Program: When referring to CFA Institute, membership, designation, or candidacy, do not misrepresent or exaggerate the meaning or implications of membership in CFA Institute, holding the CFA designation, or candidacy in the CFA program	• Don't exaggerate individual competence • Sign PCS and pay fees to keep membership live • There is no partial designation • Don't claim superiority due to passing exams quickly • Proper usage of the term "CFA" - It's an adjective, NOT a noun	Make sure that your employer is aware of the proper references to the CFA designation and CFA candidacy
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Currency Exchange Rates: Determination and Forecasting

Introduction

- USD/EUR rate of 1.3150 means that 1 Euro, the base currency costs 1.3150 dollars (price currency)
- This is a direct quote for a US investor to buy and sell EURO currency and hence an indirect quote for EU investor
- This indirect quote for EU investor can be converted into direct quote by finding the reciprocal of the direct quote, which in this case will be $1/1.3150$ i.e. 0.7605

Bid-Offer Spread

- Bid Price is the price quoted in terms of counter currency at which the dealer is willing to buy or investor can sell 1 unit of base currency
- Offer Price is quoted in terms of counter currency at which the dealer is willing to sell OR an investor can buy 1 unit of base currency
- When we converse a direct quote (USD/EUR) into an indirect quote (EUR/USD), the Bid and ask interchange

Factors Affecting Bid-Offer Spread

- Lower spread for major currency pairs because of higher liquidity, like that of EUR-USD, USD-JPY, USD-GBP, etc.
- Higher supply of one currency may result in tighter spreads and vice-versa
- Higher spreads during volatile times as against the lesser volatile times
- Spreads are lower at the time of the day when both the US and the European markets are open compared to other time of the day

Cross Currency Rates

- The implied Bid-Ask quote in a cross currency rate is computed by multiplying the bid and ask quotes of the two primary currency pairs in question
- For example, given JPY/USD bid-ask quote of 79.8600-79.8650 and USD/EUR quote of 1.2825-1.2875, one can calculate JPY/EUR cross rates by multiplying bid and ask rates for JPY/USD and USD/EUR
 - Bid: $(\text{JPY/USD})_{\text{Bid}} \times (\text{USD/EUR})_{\text{Bid}} = 79.8600 \times 1.2825 = 102.4205$
 - Ask: $(\text{JPY/USD})_{\text{Ask}} \times (\text{USD/EUR})_{\text{Ask}} = 79.8650 \times 1.2875 = 102.8262$

Triangular Arbitrage:

Following steps are undertaken to execute a cross currency triangular arbitrage:

- Step One: Calculate the implied cross currency rates
- Step Two: Compare the implied cross currency rates with the market rate or rate offered by a dealer
- Step Three: If the rate is higher at the dealer, sell at the dealer end and buy at the cross rates and vice-versa

Covered Interest Rate Parity:

- Forward exchange rate must adjust so that the arbitrage of borrowing in one currency (at lower) interest rate and investing in other currency (with higher interest rate) is not possible
- Holds in short, medium and long term when:
 - There are zero transaction costs,
 - Underlying domestic and foreign money market instruments are identical in terms of their liquidity, maturity, and default

$$\text{Forward Rate } \left(\frac{d}{f} \right) = \text{Spot Rate} * \frac{1 + \text{Domestic Interest Rates}}{1 + \text{Foreign Interest Rates}}$$

Forward Premium/Discount:

- If Forward Rate > Spot Rate → Foreign/base currency is said to be at forward premium
- If Forward Rate < Spot Rate → Foreign/base currency is said to be at forward discount
- To compute forward rate using bid-ask quotes, one needs to use the mid-quote, the average of the bid and the ask rate

Covered Interest Rate Arbitrage:

Following steps are undertaken to execute a cross currency triangular arbitrage:

- Calculate the theoretical forward rate using the covered interest arbitrage equation
- Compare the theoretical forward rate with the one offered by the dealer
- If the forward rate at the dealer is lower (greater), enter in an agreement to buy (sell) the currency in the forward market at dealer
 - Borrow in the currency you have committed to buy from the dealer → convert the borrowed amount into the other currency at the prevailing spot rate → invest the proceeds in the other currency
 - At maturity: redeem the investment → and convert back into the original currency using the forward rate locked with the dealer
 - Repay the loan along with interest and realize the arbitrage profit

Uncovered Interest Rate Parity:

- Changes in spot rates over the period should be equal to the difference in interest rates between the two countries
- This implies that exchange rate will appreciate/depreciate to just offset the interest rate differential between the two countries and current forward rate is an unbiased predictor of future spot rate

$$\text{Expected Spot Rate } \left(\frac{d}{f} \right) = \text{Spot Rate} * \frac{1 + \text{Domestic Interest Rates}}{1 + \text{Foreign Interest Rates}}$$

- Uncovered interest rate parity assumes that there are enough risk neutral investors to ensure that uncovered interest rate parity holds
- Generally, does not hold in short-medium term, however holds in long term as there is no arbitrage possible
- If both covered and uncovered interest rate parity holds →

$$\text{Forward Rate } \left(\frac{d}{f}\right) = \text{Expected Spot Rate } \left(\frac{d}{f}\right)$$

Relative Purchasing Power Parity – Ex Ante:

- Doesn't necessarily hold – in short run
- Over long term foreign currency moves to equate inflation differential between countries

$$\text{Expected Spot Rate } \left(\frac{d}{f}\right) = \text{Spot Rate} * \frac{1 + \text{Domestic Inflation Rates}}{1 + \text{Foreign Inflation Rates}}$$

International Fisher Relation:

- When uncovered interest rate parity and ex ante PPP holds, the difference between domestic and foreign real interest rates will be zero → Same domestic and foreign real interest rates
- Foreign and domestic nominal yield spread will be determined by foreign and domestic expected inflation differential.

Carry Trade:

- Carry trade involves going long (lending/investing) in high yielding currencies and going short (borrowing) in the low yielding ones
- Returns for carry trade are not normally distributed but they are
 - More peaked
 - Negatively Skewed
 - Fat Tails
- Carry trade returns are volatile returns because they are highly leveraged and measures are used by traders to reduce negative returns:
 - FX Volatility Filter
 - PPP Benchmarks

Economic Growth and Investment Decision

Cobb – Douglas Production Function

A two factor production function, where the output/GDP (Y) is a function of labor (L) and capital (K) for a given level of technology (A)

$$Y = F(K, L) = AK^\alpha L^{1-\alpha}$$

- α and $(1 - \alpha)$ are the share of output that are allocated to capital and labor respectively and its value is between 0 and 1
- A is a scale factor that represents technological progress and is referred as total factor productivity

- The Cobb-Douglas production function represents constant returns to scale and law of diminishing marginal productivity
- Expressing the Cobb-Douglas production in terms of per unit of labor:
 - $Y/L = A (K/L)^\alpha (L/L)^{1-\alpha}$;
 - $y = Ak^\alpha$; where, $k = K/L$ & $y = Y/L$
- Output per worker is a function of technology (A) and capital per worker (k)

Capital Deepening Vs. Technological Progress

- As α for the developed economies is close to 0, additional capital per worker (capital deepening) will not increase output by any significant account
- This implies that for stronger per capita output growth, developed economies have to be dependent on technology (technological progress)
- The reverse is the case for a developing one, where α is close to one additional capital results in significantly higher economic growth
- Thus, capital deepening is source of growth for developing countries, whereas technological progress is the source of growth for the developed

Growth Accounting

- Growth Accounting is Cobb-Douglas Production function written in the form of growth rates
- It breaks down the % change in economic growth to % change in capital, labor and technology

$$\Delta Y/Y = \Delta A/A + \alpha \Delta K/K + (1 - \alpha) \Delta L/L$$

- Given α , K, L and Y, one can solve for contribution of A to the economic growth

Natural Resources and Economic Growth

- Sometimes the presence of natural resources may restrain growth rather than enhancing them.
 - Countries rich in natural resources may not develop other economic institutions necessary for growth
 - Dutch Disease which is currency appreciation driven by strong export of natural resources making other export sectors globally uncompetitive
 - Over dependence on non-renewable resources for growth may result in their depletion which may stall the growth

Return Concepts

Estimating Required Return on Equity

MODELS	EXPLANATION
Single factor model	CAPM: $RR = R_f + \beta(R_M - R_f)$ RR = required return R_f = Risk free rate β = Beta (systematic risk) $(R_M - R_f)$ = ERP

Fundamental Multi-factor models	Fama-French Model (FFM): $RR = R_f + \beta_i^{mkt}(RM - R_f) + \beta_i^{size}(SMB) + \beta_i^{value}(HML)$ $RM - R_f$ = market risk premium (same as CAPM) SMB = premium for small capped stocks HML = premium for high book-to-market stocks (low PBV) β represents asset's sensitivity to a factor while the risk premiums drive returns Interpretation: • $\beta_i^{mkt} > 1 \rightarrow$ the company has above average market risk • $\beta_i^{size} > 0 \rightarrow$ the company is small cap when compared to avg mkt • $\beta_i^{value} > 0 \rightarrow$ the company has value orientation (has high book to market or low PBV) Pastor-Stambaugh Model (PSM): $RR = R_f + \beta_i^{mkt}(RM - R_f) + \beta_i^{size}(SMB) + \beta_i^{value}(HML) + \beta_i^{liq}(LIQ)$ • Incorporates Liquidity Premium (LIQ); where $\beta_{liq} > 0 \rightarrow$ the company is relatively less liquid
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Discounted Dividend Valuation

Dividend Discount Models

Gordon Growth Model (GGM) – Single Stage (constant growth)	$V_0 = \frac{D_0(1+g)}{r-g} = \frac{D_1}{r-g}$
Multi Period Model	$V_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \dots + \frac{D_n + P_n}{(1+r)^n}$ $V_0 = \sum_{t=1}^n \frac{D_t}{(1+r)^t} + \frac{P_n}{(1+r)^n}$

H-model DDM

- Assumes company's initial high growth rate (g_s) steadily declines over initial phase till it reaches a steady long-term growth rate (g_L)

$$V_0 = \frac{D_0(1 + g_L)}{r - g_L} + \frac{D_0H(g_s - g_L)}{(r - g_L)} \quad \text{where } H = \text{high growth period} / 2$$

Terminal Value calculated using

- Gordon Growth model or
- Multiple to a projected terminal value of a fundamental like EPS, BV, etc;

Sustainable Growth Rate (SGR)

Rate of dividend (and earnings) growth that can be sustained forever

- $g = b \times \text{ROE}$
- Assumptions:
 - Capital structure is constant
 - Additional common stock is not issued

$$g = \frac{\text{NI} - \text{Dividends}}{\text{NI}} \times \frac{\text{NI}}{\text{Sales}} \times \frac{\text{Sales}}{\text{TA}} \times \frac{\text{TA}}{\text{SH Equity}}$$

Pricing and Valuation of Forward Commitments

Forward Contract:

- Forward contract** is an agreement in which the buyer agrees to purchase the underlying asset or from the seller at a pre-agreed price that is to be paid at a future date
- Long* = Buyer = Pays Cash/Receives Asset
- Short* = Seller = Delivers Asset/Receives Cash
- Forwards provide a hedge against future increase or decrease in prices → price-lock

VALUE OF EQUITY FORWARD CONTRACT
$V_0 = S_0 - PV(\text{Dividends}) - \frac{F(0, T)}{(1 + r)^T} = 0$
$V_t = S_t - PV(\text{Dividends}) - \frac{F(0, T)}{(1 + r)^{(T-t)}}$
$V_T = S_T - F(0, T)$

Value and Price of Currency Forwards

PRICE OF CURRENCY FORWARD	NOTES
$F(0, T) = \left[\frac{S_0}{(1 + r^f)^T} \right] \times (1 + r^d)^T$	S_0 = direct quote in units of domestic (price) currency per unit of the asset or foreign (base) currency
$F(0, T) = (S_0 e^{-r^f T}) e^{r^d T}$	r^d = Domestic Int. Rate r^f = Foreign Int. Rate

VALUE OF CURRENCY FORWARD
$V_t(0, T) = \frac{S_t}{(1 + r^f)^{(T-t)}} - \frac{F(0, T)}{(1 + r^d)^{(T-t)}}$
$V_t(0, T) = S_t e^{-r^f(T-t)} - F(0, T) e^{-r^d(T-t)}$

Swap Contracts

- Contract between two parties to swap or exchange sequence of future cash flows
- Often one party makes fixed payments and the other, variable or floating payments
- Swap = series of *off-market* forward contracts
- Interest Rate Swap = Series of Long calls + Short puts

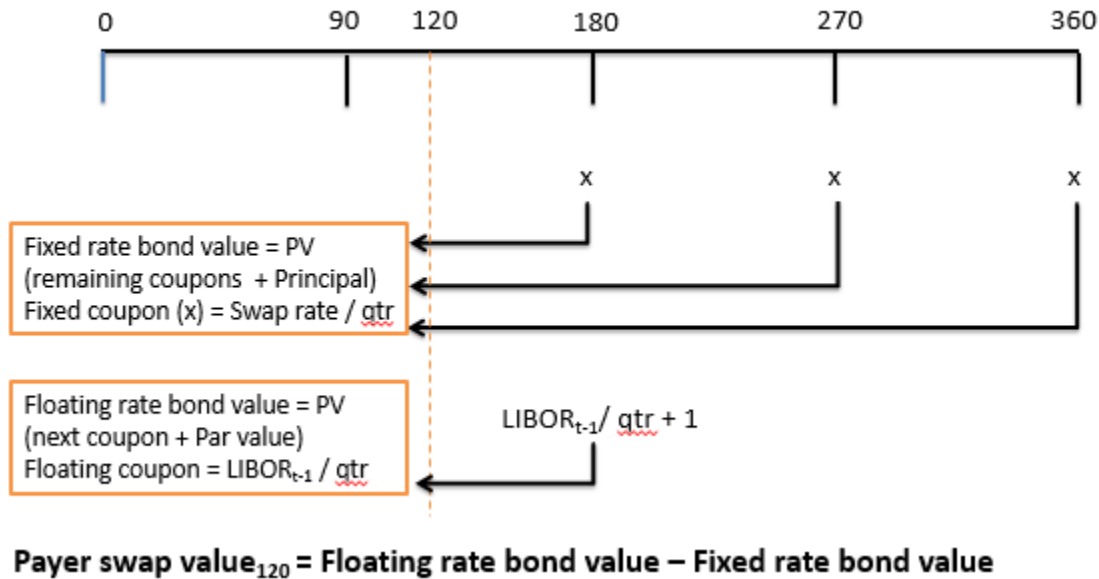
Calculating Swap Fixed Rate

$$c = \frac{1 - DF_n}{DF_1 + DF_2 + DF_3 + DF_4 \dots + DF_n}$$

Where, c = the periodic swap rate or the periodic fixed coupon

Valuing Interest Rate Swaps

- **Fixed-rate payer swap value = $PV_{\text{float}} - PV_{\text{fixed}}$**
- Note: On any coupon reset dates, the floating rate bond will have a value of 1 or par since interest rates would be adjusted to reflect market rates



Valuation of Contingent Claims

Greeks

GREEK	INPUT	CALL OPTION PRICE	PUT OPTION PRICE
Delta	Asset Price (S)	+ Delta > 0	- Delta < 0
Rho	Risk-Free Rate (r)	+ Rho > 0	- Rho < 0
Theta	Time to Expiration (measured as time value decay) (T)	+ Theta < 0	+ (mostly) Theta < 0
Vega	Volatility (σ)	+ Vega > 0	+ Vega > 0

Delta

- Delta measures sensitivity of option price to asset price, just like market beta or bond duration
- Delta = Change in option price / Change in underlying asset price
- Call delta = $N(d_1)$ and Put delta = $N(d_1) - 1$
- Call deltas range from 0 to 1:
 - Far out-of-the-money: Delta approaches 0
 - Far in-the-money: Delta approaches 1
- Put deltas range from -1 to 0:
 - Far out-of-the-money: Delta approaches 0
 - Far in-the-money: Delta approaches -1

Delta Hedging

- The goal of a delta neutral portfolio is combine long position in stock and short position in call to create a portfolio which is neutral to market movements.
- Discrete time: $\text{Delta}(\text{Call}) = \frac{C_1 - C_0}{S_1 - S_0} = \frac{\Delta C}{\Delta S}$
- Delta hedging or Dynamic hedging since delta keeps on changing so position needs to be continuously hedged dynamically
- For calls: Delta-neutral Hedge = long asset + short calls
 - Value of the portfolio does not change when the stock price changes
- No. of options** = $\frac{\text{No. of shares}}{\text{Delta}}$

Gamma

- Gamma describes the curve or the delta's sensitivity to change in the underlying
- Gamma = change in delta / change in underlying asset price
- Higher gamma means that delta will not work for large changes in underlying price
- Gamma is large when option is at-the-money and close to expiration

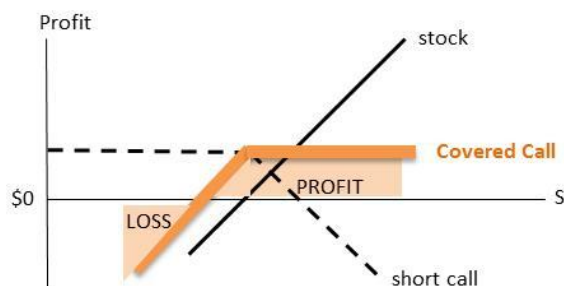
Derivative Strategies

Key Symbols

- X = strike (exercise) price specified in the option contract
- X_L = low exercise price
- X_H = higher exercise price
- S_t = price of the underlying asset at time t
- $C_t(P_t)$ = the market value of a call (put) option at time t
- C_{L0} = call with lower exercise price (P_{L0} for put)
- C_{H0} = call with higher exercise price (P_{H0} for put)
- V_0 = value at initiation
- V_T = value at time t

Covered Call

- A conservative strategy in which you own a stock and sell a call
- Expect the security price to remain relatively stable over the short term and hence seek additional return from the call's premium



$$\text{Profit: } S_T - \max(0, S_T - X) - S_0 + C_0$$

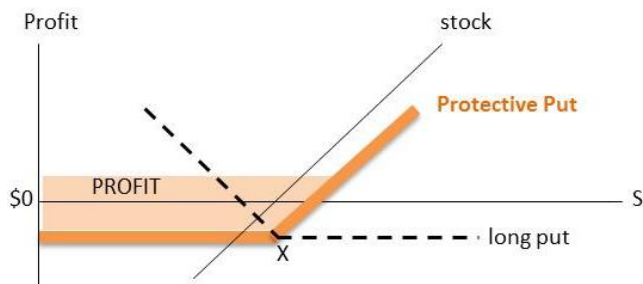
$$\text{Maximum profit} = X - S_0 + C_0$$

$$\text{Maximum loss} = S_0 - C_0$$

$$\text{Breakeven price} = S_0 - C_0$$

Protective Put

- Insurance strategy of holding an asset and a put
- It offers downside protection against a fall in the price of the asset
- Upside potential still remains reduced by the put's premium



$$\text{Profit: } S_T + \max(0, X - S_T) - S_0 - P_0$$

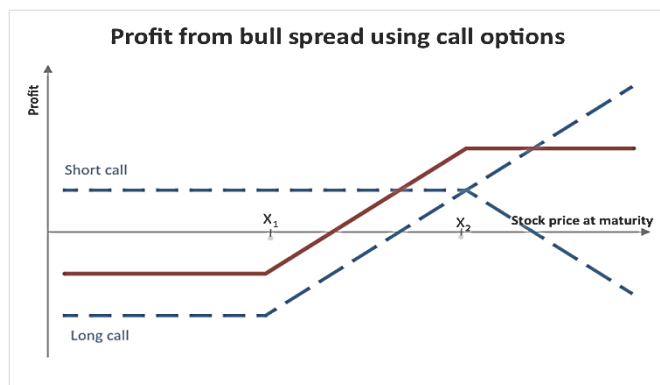
Maximum profit = Unlimited

$$\text{Maximum loss} = S_0 - P_0 - X$$

$$\text{Breakeven price} = S_0 + P_0$$

Bull Call Spread

- Designed to make money when the investor is bullish
- Involves 2 call options, one long and one short, with the short call premium subsidizing the long call
- Long call is more expensive than short call. ($C_{L0} > C_{H0}$)
 - LONG – Buy a call option with a low exercise price, X_L at price C_{L0}
 - SHORT – Sell a call with a higher exercise price, X_H at C_{H0}
- Limited upside and downside
- Can also be executed using puts instead of calls.



$$\text{Profit: } \max(0, S_T - X_L) - \max(0, S_T - X_H) - C_{L0} + C_{H0}$$

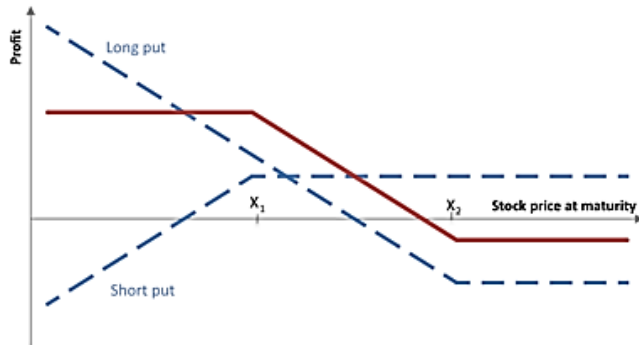
$$\text{Maximum profit} = X_H - X_L - C_{L0} + C_{H0}$$

$$\text{Maximum loss} = C_{L0} - C_{H0}$$

$$\text{Breakeven price} = X_L + C_{L0} - C_{H0}$$

Bear Put Spread :

- Purchase put with high strike price and sell put with low strike price
- Can also be executed using calls instead of puts.

Profit from bear spread using put options

$$\text{Profit: } \max(0, X_H - S_T) - \max(0, X_L - S_T) - P_{H0} + P_{L0}$$

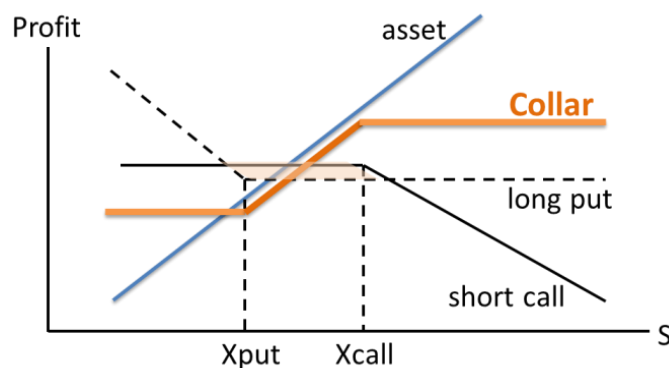
$$\text{Maximum profit: } X_H - X_L - P_{H0} + P_{L0}$$

$$\text{Maximum loss: } P_{H0} - P_{L0}$$

$$\text{Breakeven price: } X_H - P_{H0} + P_{L0}$$

Collar

- A collar is a conservative strategy combining a Covered Call and a Protective put (using the same asset)
- It is created by the investor who buys a Protective put, where the investor is
 - Long the underlying stock
 - Long the put option
 - Short a call to pay for the put
- A **zero-cost** collar if the both premiums are equal and offset each other



$$\text{Profit} = \max(0, X_L - S_T) - \max(0, S_T - X_H) + S_T - S_0 - P_0 + C_0$$

$$\text{Maximum profit} = X_H - S_0$$

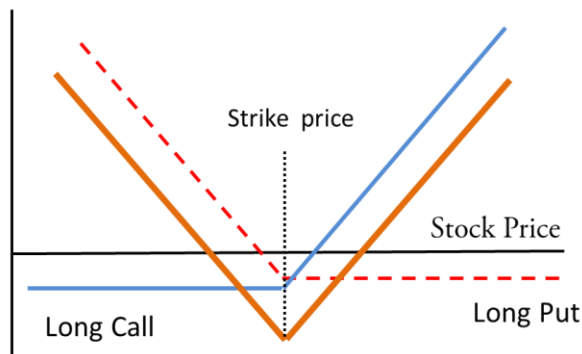
$$\text{Maximum loss} = S_0 - X_L$$

$$V_0 = \text{Breakeven price} = S_0 \text{ (zero cost collar)}$$

Straddle

- An investor may take a LONG straddle position if the expectations are that the market is highly volatile, but is unsure of the direction
- A LONG straddle involves buying BOTH a put and a call on the same asset with the same exercise price and expiration (maturity)
- The greater the volatility in stock prices, the greater the payoff (profit) regardless of direction of the price movement
- This position has a limited risk, since the maximum loss is the cost of both options

Profit/Loss



$$\text{Profit} = \max(0, S_T - X) + \max(0, X - S_T) - C_0 - P_0$$

$$\text{Maximum profit} = S_T - X - C_0 - P_0$$

$$\text{Maximum loss} = C_0 + P_0$$

$$\text{Breakeven price} = X \pm (C_0 + P_0)$$

- $X - C_0 - P_0$
- $X + C_0 + P_0$

Private Real Estate Investments

PRIVATE VS PUBLIC REAL ESTATE INVESTMENTS	
Public (Indirect)	• Investment in REITS, REOCs and MBSs • Liquid and offer diversification
Private (Direct)	• Purchasing property directly using equity or lending money to purchaser • Requires management at the part of investor • Illiquid and indivisible

DEBT VS. EQUITY REAL ESTATE INVESTMENT	
Equity	• Ownership interest in real estate or in shares of company which owns real estate • Offer income and capital return
Debt	• Ownership interest in mortgages or mortgage securities • Fixed stream of cash flows

REAL ESTATE RISKS AND RETURNS	
Characteristics & Risks	Heterogeneity, high unit value, high transaction cost, depreciation and desirability, illiquid, difficult to value
Returns	Income, capital appreciation, inflation hedge, diversification, tax benefits

Publicly Traded Real Estate Securities

Advantages /Limitations of publicly traded Real Estate Securities

- More liquid, smaller units of investment, greater diversification
- Might be tax advantaged, limited liability
- Professional management and access to premium properties.
- Lack of control, price is determined by stock market, lack of flexibility etc. are among limitations

TYPES OF PUBLICALLY TRADED SECURITIES	
Equity Securities	• Ownership in REITs – Tax advantaged companies that own income producing properties • Ownership in Real Estate Operating Companies (REOC) – companies that own real estate but are not tax advantaged
Debt Securities	• Holding MBSs • Investment in Mortgage REITs i.e. vehicles that investment in MBSs and mortgages
REAL ESTATE INVESTMENT TRUSTS (REITS)	
Investment Characteristics	• REITs invest in income generating properties • They are exempt from corporate level tax • They offer high dividend yield and stable income stream • Frequent equity issues
REITs Risk	• Might invest in properties where there is gap in demand and supply
Valuation - NAVPS	• Net Asset Value Per Share – amount by which market value of assets exceed liabilities, on a per share basis • $\text{NAVPS} = (\text{Property Value} + \text{Other Assets} - \text{Liabilities}) / \text{No of Shares}$ • $\text{Property Value} = \text{NOI}_1 / \text{Cap rate}$
REIT Valuation – Funds From Operations (FFO)	$\text{FFO} = \text{Accounting net earnings} + \text{depreciation expense} + \text{deferred tax expenses} - \text{gain from sale of property and debt restructuring} + \text{loss from sale of property and debt restructuring}$
REIT Valuation - Adjusted Funds from Operations (AFFO)	$\text{AFFO} = \text{FFO} - \text{non-cash (straight-line) rent adjustment} - \text{recurring maintenance type capital expenditures and leasing commissions}$
Price to FFO & Price to AFFO	Relative valuation methods
Discounted Cash Flow Approach	Methodology of using DDM and DCF are the same as stocks in general

Private Equity Valuation

Sources of value creation in Private Equity

- Ability to **re-engineer** the firm and generate superior returns
- Ability to **access debt** financing on favourable terms
- Better **alignment of interests** between PE firm and portfolio company managers

Alignment of interests between PE firm and portfolio company managers

- Corporate board seats
- Non-compete clause
- Preferred dividends and liquidation preference
- Reserved matters
- Earn-outs

EXIT ROUTE	IMPACT ON VALUE
Initial public offering (IPO)	Highest valuation due to enhanced liquidity, access to significant capital
Sale in secondary market	Highest valuation after IPO Sale to strategic investor or another PE to add further value
Management Buyout (MBO)	Takeover by the management group using significant leverage Optimal alignment of interest
Liquidation	Results in floor value and negative publicity

Private Equity fund structures



PRIVATE EQUITY FUND: ECONOMIC TERMS	
Management Fees	% of committed capital paid to GP
Transaction Costs	Advisory fees paid to GP to provide investment banking services for a transaction
Carried Interest	GPs share of profits (around 20%)
Ratchet	Increase in equity allocation to portfolio company's management
Hurdle Rate	Min. required rate of return before the GP receives any carried interest

Target Fund	Absolute amount of fund size
Vintage Year	Year the fund was launched
Term of Fund	Tenor of fund (typically 10 years + extension)

PRIVATE EQUITY FUND: TERMS	
Clawback provision	- Underperformance of fund during later years requires the GP to pay back excess portion of early profits based on agreed split back to the LPs - Due on termination or annual reconciliation (true-up)
Distribution Waterfall	- Method determining flow of profit to LPs before the GP receives carried interest 2 distinct distribution mechanisms 1st mechanism: Deal-by-deal method: early distribution of carried interest after each individual deal 2nd mechanism: Total Return method: early distribution as carried interest is calculated on the profits of the entire portfolio Alternative 1: only after fund has returned the entire committed capital to LPs Alternative 2: only when: Exit value > threshold amount above invested capital
Tag-along, drag-along rights	Acquisition offer must be extended to all shareholders
No-fault divorce	Permits termination of GP or fund if majority of LPs agree
Removal for “cause”	Removal of GP or early termination of fund if majority of LP’s agree given sufficient cause
Co-investment	Permits LPs to invest in other funds of GP at low cost
Investment Restrictions	Impose a minimum level of diversification of fund’s investments

Financial performance of private equity funds from the perspective of an investor

IRR is the most appropriate measure as per GIPS (Gross vs Net IRR)

Multiples are used frequently as a measure of performance (easy to use and differentiate between realized and unrealized portfolio but ignores TVM)

- PIC (Paid in Capital)** = paid in capital / Committed capital
- DPI (Distributed to paid in)** = cumulative pay-outs to LPs / Invested capital

- **RVPI (Residual value to paid in)** = Residual value / Invested capital
- **TVPI (Total value to paid in)** = DPI + RVPI

Commodity and Commodity Derivatives: An Introduction

Characteristics of Commodity Sectors

- Energy: Oil stored briefly and then refined and transported. Natural gas needs little processing, shipped by pipeline.
- Grains: Seasonal production, storability
- Metals: Storability
- Livestock: Production cycles vary
- Softs: Cash crops, produced in warm climates

Types of Market Participants in Commodity Future Markets

- Informed Investors: Hedgers and Speculators
- Arbitrageurs
- Exchanges, Analysts and Regulators

Spot prices Vs. Expected Futures Prices

- **Contango:** Futures Price > Spot Price
- **Backwardation:** Futures Price < Spot Price
- **Basis:** Spot price – Futures Price
- **Calendar Spread:** Difference between futures for same commodities expiring at different dates
 - **Basis and Calendar spreads:** Negative in contango and positive in backwardation

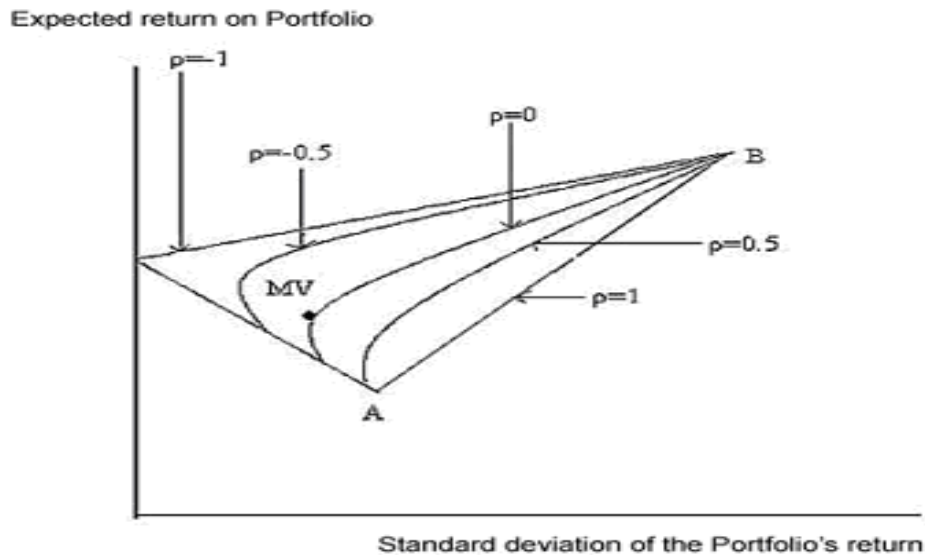
Portfolio Theory

Mean Variance Portfolio

- **Expected return (Mean)** of portfolio of assets is the sum of weighted returns of the individual assets in the portfolio
 - $E(R_p) = w_1E(R_1) + w_2E(R_2) + w_3E(R_3) + \dots + w_NE(R_N)$
 - where, ' w_i ' is weight of individual asset
- **Variance** of a portfolio is the sum of two main components;
 - the weighted average of variance of individual securities, and
 - the co-variance between securities based on their individual weights
 - So for a 2 asset portfolio, risk of the portfolio is:
 - $Var(R_p) = \sigma_A^2 w_A^2 + \sigma_B^2 w_B^2 + 2w_A w_B Cov_{AB}$
 - OR
 - $Var(R_p) = \sigma_A^2 w_A^2 + \sigma_B^2 w_B^2 + 2w_A w_B \rho_{AB} \sigma_A \sigma_B$
- **Covariance** measures the degree to which returns on two assets move together.
 - *Positive covariance* implies returns move in the same direction.
 - *Negative covariance* implies the returns of the assets are inversely related.
 - *Zero covariance* implies there is no relation between the returns of the assets.

- **Correlation coefficient** addresses the limitation of covariance. It measures the *strength of dependence*, i.e. how much the dependence of one asset's return is on the other asset. Correlation co-efficient ranges from -1 to +1.

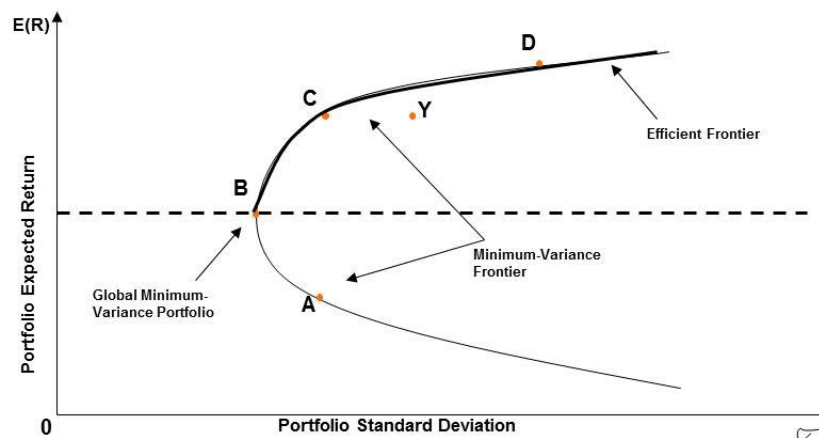
Portfolio Risks – Correlation between Assets



As correlation between assets $\downarrow$ benefits of diversification $\uparrow$

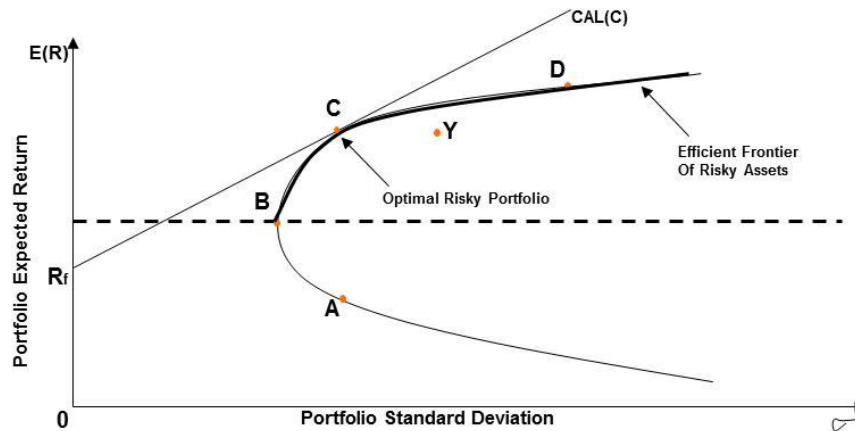
Minimum Variance and Efficient Frontier

- As the number of available assets increases, investors have more possibilities for combination of the assets. If we select the combinations that result in minimum-variance portfolios, we achieve what is known as the minimum-variance frontier
- **Minimum-variance frontier** is a graph that represents the minimum-variance portfolios, i.e. portfolio of risky assets with lowest variance (A, B, C, D)
- The portfolio (B) of the left-most corner of the frontier, with the least variance or risk is termed as the **Global minimum-variance portfolio**
- All portfolios that lie above and to the right of global minimum-variance portfolio make up the **Markowitz efficient frontier**. Efficient frontier may be defined as a graphical representation of a set of feasible portfolios (B, C, D) that have the maximum return for a given level of risk



Optimal Risky Portfolio for an Investor

- When risk-free asset is combined with the risky assets on the efficient frontier, we obtain a linear relationship, i.e. a straight line. This line is called the **capital allocation line (CAL)** and is **tangent** to the efficient frontier
- The point of tangency (C) is termed as the **optimal risky portfolio**



Portfolio Choices Based On Indifference Curve

- The ideal portfolio for an investor, who prefers to keep a mix of both risky and risk free assets, will lie between optimal risky portfolio and R_f .

Risk Adjusted Return Measures

- M-Squared** measure produces the same portfolio rankings as the Sharpe Ratio but is stated in percentage terms.
 - The M^2 measure for P2 is $(R_{P2} - R_f) (\sigma_M / \sigma_{P2}) - (R_M - R_f)$
- Treynor measure:** Same as Sharpe ratio except the risk is measured by Beta
 - $(R_P - R_f) / \beta_P$
- Jensen's Alpha:** Excess return between realized return and required return
 - $R_P - [R_f + \beta_P (R_M - R_f)]$

Measuring & Managing Market Risk

Value at Risk (VAR)

- It is measure of downside risk that states the minimum loss with a given probability over a specified period of time. It can be expressed in dollar amount or as a percentage value.
- Example:** 1% probability that a portfolio will face a minimum loss of \$50,000 in any given month.

Approaches for Estimating VAR

Approach	Description	Key Points
Parametric method	- Assumes normal distribution. - Used mean and variance to estimate VAR. $= E(R_P) - z \times \sigma_P$	- Sensitive to input estimates. - Only useful when normality is a fair assumption.

	The value of z depend on the probability (5% = 1.65, 1% = 2.33)	Period used for input calculation can affect the outcome.
Historical method	- Uses historical distribution of risk factors to determine the VAR. - For e.g., the 5% VAR will be the value beyond the 5th percentile.	- No distributional assumptions. - Can be used even when portfolio contain options. - Data from unusual periods will adversely affect the computation.
Monte Carlo Method	- Defines distribution for each risk factors. - Draw values of risk factors from the distribution and calculates portfolio return. - Repeats the process 1000s of time and generates a distribution of portfolio returns. - VAR is then calculated similar to historical simulation.	- Considers scenarios that haven't occurred in past. - Output is only as good as the inputs. - Complex and expensive.

Merits & Demerits of VAR

Merits	Demerits
- Simple and easy to understand. - Allows comparison of risk between different asset classes. - Can be used to calculate risk adjusted return and compare performance across managers. - Useful tool for allocating risk (risk budgeting). - Accepted risk measures by regulators in many industries. - Can be verified via back testing.	- Ignores risk from fat tailed events under assumption of normality. - Only focuses on downside risk. - Focus on market risk and therefore other risks (e.g. liquidity risk). - Choice of probability and time period causes subjectivity.

Extension of VAR

Conditional VAR (CVAR)	Calculates the average losses that excess the VAR. Also known as tail value at risk.
Incremental VAR	The change in VAR from a specific change in weight of a security in the portfolio.
Marginal VAR	Provided an approximation of change in VAR for 1% change in portfolio weight of security. Useful for small changes in weight.
Relative VAR	Measures the relative underperformance of a portfolio with respect to its benchmark at a specified probability over a specified period.

Complements to VAR

Sensitivity Analysis	- Analyses the impact on the portfolio for a small change in one risk factor. - For example: change in a fixed income portfolio from 1% change in interest rates (hint: duration) - Unlike VAR, it does not provide any information about probability of movement in the risk factors.
Scenario Analysis	- Analyses the impact on the portfolio for a set of changes in multiple risk factor. - Can be historical or hypothetical. Stress test examines the impact on the portfolio under a scenario extreme changes in risk factor. - A reverse stress test is used to identify scenarios that would cause business failure. - Unlike VAR, it does not provide any information about probability of occurrence of a specific scenario.

Constraints

Risk Budgeting	Identifies the overall risk tolerance and then allocates the same among different strategies, asset classes etc.
Position Limit	- Place an upper limit on the market exposure that be taken on an investment. - Can be expressed in dollar values or in percentages. They can also be expressed as a function of trading volume. - This ensures a minimum level of diversification.
Stop Loss Limit	Exit or reduce an exposure to an investment when loss exceeds a specified value.
Scenario Limit	Requires corrective action if the loss reaches a specified amount in a given scenario.

Analysis of Active Portfolio Management

Benchmark Portfolio must be:

- Representative* of the universe from which the portfolio manager selects the securities
- Replicable* inexpensively if desired
- Predictable* such that benchmark weights are known in advance

Active weights: difference between the weight in the portfolio vis-à-vis its weight in the benchmark

Ex-ante ante active return:

$$E(R_A) = E(R_p) - E(R_B)$$

$$E(R_A) = \sum [(w_{pi} - w_{bi}) \times E(R_i)]$$

Active Returns for multi-asset class investment

Approach 1:

- *Step 1: Calculate expected returns for active portfolio*

$$E(R_p) = \sum [(w_{p,j})(E(R_{p,j}))]$$

- *Step 2: Calculate expected returns for benchmark*

$$E(R_B) = \sum [(w_{B,j})(E(R_{B,j}))]$$

- *Step 3: Ex-ante active return is the difference between the 2 returns calculated above*

$$\text{Active Return: } E(R) = E(R_p) - E(R_B)$$

Approach 2:

Return from asset allocation	a. Difference between asset class weights in the portfolio and in the overall benchmark X b. Asset class returns in the overall benchmark
Return from security selection	a. Asset class weights in the portfolio X b. Active returns for each asset class: difference between asset class returns in the portfolio and in the benchmark

Active Return: $E(R) = \text{Return from asset allocation} + \text{return from security selection}$

Algorithmic Trading and High-Frequency Trading

Algorithmic Trading

- It involves use of computers in execution of trading strategy. The objective is to increase the speed of execution and reduce human error while making the same kind of decisions as humans.

Types of Algorithms

Execution Algorithms	• It slices the large order into smaller pieces with an objective to minimize price impact.
High-Frequency Trading Algorithms	• Analyses real time market information to exploit profitable market opportunities. Securities are usually held only for a short period of time.

Types of Execution Algorithms

VWAP Algorithms	Splits the trades based on historical trading volume with an objective of trading higher volumes when market has greater depth.
Implementation Shortfall Algorithms	Tries to minimize the difference between the decision price and execution price by balancing the urgency to trade with missed trade opportunity cost.
Market Participation Algorithms	Trades are sliced proportionally to actual trading volume.

Types of High Frequency Trading Algorithms

Statistical Arbitrage Algorithms	- Identifies deviation in historical relationships among securities and trades to profit from their convergence to historical relationships. - Examples: pairs trading, index arbitrage, basket trading & spread trading, mean reversion & delta neutral strategies.
Real Time Pricing of Securities	Assist dealers in adjusting their bid-ask spread using real time analysis of price and liquidity information from the market.
Trading on News	Uses high frequency news feed on economic and company specific information to execute trades based on pre-specified triggers.
Genetic Tuning	Self-evolving trading systems which tests different trading strategies and then kills unsuccessful ones and continues with profitable ones.
Liquidity Aggregators and Smart Order Routing	Aggregates liquidity and routes orders in the most liquid markets to minimize market impact.

Risk Management

Real Time Pre Trade Firewall	- Continuously calculates risk exposure and blocks trades exceeding risk limits. - Also protects against erroneous trades.
Back Testing & Market Simulation	Algorithms can be back tested to simulate their performance in historical scenarios and assess risk of trading strategies.

Regulatory Oversight

- Algorithms can be used by regulators for real time monitoring and surveillance.
- The circumstances that may lead to scrutiny are **insider trading, front running, painting the tape (influencing price through circular trading) & fictitious trades (quote stuffing, layering, spoofing, wash trading and collusion)**.

Positive and Negative Impact of Algorithms

Positive Impact	Negative Impact
Facilities large trade, increase liquidity, lower cost, improved pricing efficiency, open & competitive market & increased competition among trading venues.	Unfair speed advantage, magnifying market movements, market manipulation, risk of trading errors and out of control algorithms.

Fixed Income: Duration & Convexity

Approach to Measure Interest Rate Risk

MEASURE OF INTEREST RATE RISK	DESCRIPTION
Macaulay Duration	Macaulay is the weighted average number of years necessary to recover the initial cost of the bond
Modified Duration	- Macaulay duration can be used to calculate Modified Duration - Modified Duration = Macaulay Duration / (1+YTM) - Modified duration can be approximated by: $\frac{\text{Price with Yield decline} - \text{Price with Yield rise}}{2 * \text{Initial Price} * \text{Change in yield}}$
Effective Duration	For calculating the duration of bonds with options, a better measure is Effective duration, which takes into account the change in expected cash flows with interest rate changes $\frac{\text{Price with Yield decline} - \text{Price with Yield rise}}{2 * \text{Initial Price} * \text{Change in curve}}$

Price-Yield Function

- The P-Y function is positively convex for option free bonds.
- Price decline is smaller when yield increases than the price rise when the yield decreases
- The P-Y function is negatively convex for callable bonds at low yields.

Convexity

- Price change calculated using the bond duration measure is not accurate due to convexity
 - Duration overestimates price declines and underestimates price increases
- Convexity is the second derivative of P – Y function
 - Option free bonds have positive convexity (price decline is smaller when yield increases than the price rise when the yield decreases)
 - Callable bonds have negative convexity at lower interest rates (the absolute change in price is less as interest rates decline than when they rise)
- Approximate convexity:

$$\frac{\text{Price with Yield decline} + \text{Price with Yield rise} - 2 * \text{Initial Price}}{\text{Initial Price} * (\text{Change in yield})^2}$$

- Convexity adjustment to approximate price change =

$$(1/2) * \text{Convexity} * (\Delta \text{Yield})^2 * 100$$

- Approximate price change given Duration and Convexity =

$$- \text{Duration} * \Delta \text{Yield} * 100 + (1/2) * \text{Convexity} * (\Delta \text{Yield})^2 * 100$$