Portfolio Management

Ig 38 : Portfolio Mngmt : An Overview

folio perspective on Investing

- **Portfolio Approach**
  ↳ Evaluate individual investments by their contribut to risk & return of investors portfolio
- Portfolio diversificat helps investors avoid dist disastrous invst outcomes. Also helps reduce risk

Lower the better → **Diversification Ratio** = Risk of equally wt. portfolio of n securities / Risk of single security selected at random

- Composit matters for risk-return tradeoff
- Portfolios do not provide downside protect

✳ Investment Clients

	Time Horizon	Risk Tolerance	Inc Needs	Liquidity needs
Individual Investors	Vary	Vary	Vary	Vary
→ Risk transferred to employee				
DB pension plans	Long	High	High → Mature funds Low → growth funds	Low
Endowments & foundat	Very Long	High	Spending Commitment	Low

University endowment → longest time horizon
Inst comp mng. invst in mutual funds

	Time Horizon	Risk Tolerance	Inc. Needs	Liquidity needs
Banks	Short	Low	Low	High
Insurance Companies (P&C)	Short	Low	Low	High
Insurance Comp. (Life)	Long	Low	Low	High
Investment Companies	Vary	Vary	Vary	High

Steps in Portfolio Mngmt Process

(1) Planning
- Understanding clients needs
- Preparation of investment policy statement

(2) Execution
- Asset allocation
- Security analysis
- Portfolio construction

Top-down approach = Macro eco analys → Ind. analy → Security analy
Bottom-up approach = Focus on company specific circumstances

(3) Feedback
- Portfolio monitoring & rebalancing
- Performance measurement & reporting

Strategic asset allocatn & rebal policy - in Appendices

Steps to keep IPS current & proc to follow to respond to contingencies in Procedures

- Sell-side firm
  - ↳ Broker/Dealer who sells securities to & provides invstment research & recommendatn to invst mngmt companies

- Buy-side firm
  - ↳ Invst mngmt companies that use services of sell side firms

* Pooled Invstments

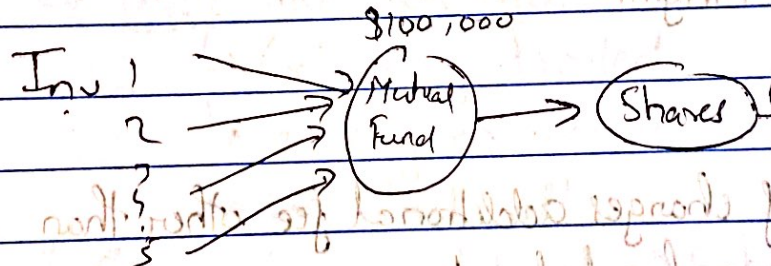
Invstment Product	Minimum Invstment
• Mutual Funds	$50 +
• Exch. trade funds (ETF)	$50 +
• Separately Mnged Accts	$100,00 +
• Hedge Funds	$1,000,000 +
• Private Equity Funds	$1,000,000 +

Mutual Funds

- Comingled invstment pool in which each investor has pro-rata claim on income & value of fund.

- Consider following example:
  An invst firm raises $100,000 from 5 investors & issues 10,000 shares. Each share has value of $10.

Investor	Act. invsted	% of Total	No. of shares
John	4,000	4%	400
Jill	6,000	6%	600
Joe	10,000	10%	1,000
Jones Co.	50,000	50%	5,000
Widget Co.	30,000	30%	3,000



So each share val. is approx $15

- Net Asset Value (NAV)
  ↳ Assets − Liabilities (A−L)

- Net Asset Value per share (NAVPS)
  ↳ $\frac{A-L}{\text{no. of shares}}$

- Open-end funds | Evergreen (Commonly used)
  ↳ Accept new invst money & issue additional shares.

- Closed-end funds
  - ↳ Do not accept new invst money

Open End Funds	Closed End Funds
Trades at NAV	NAV ↕
Buy/sell based on closing prices	Like regular shares

- Mutual funds charge annual fee (usually 2%) for assets under mngmt
- Load fund
  - ↳ If mf charges additional fee other than annual fee then its a load fund.
- No-load fund
  - ↳ Fund that charges only annual fee
- Funds can also be categorized based on types of investments
  - ↳ Money market
  - ↳ Bond mutual funds
  - ↳ Stock mutual funds
  - ↳ Index mutual funds

- Open-end no-load fund → highest pressure to manage liquidity

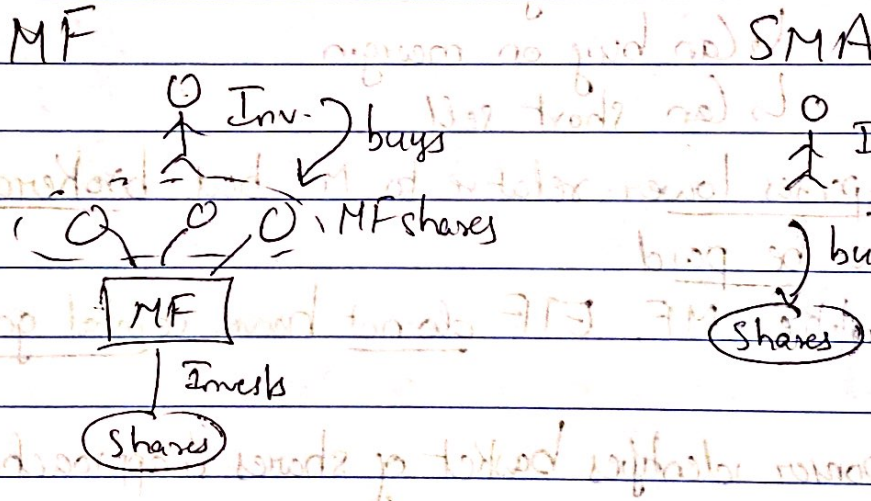
Exchange Traded Funds

- Pooled invst vehicle & often based on index.
- With indx MF, inv. buys from the fund.
  (ETF, other investors)
- ETF's combine features of closed-end & open-end funds
  - ↳ Tracks NAV like open-end funds
  - ↳ Trade like close-end
    - ↳ Continously Traded
    - ↳ Can buy on margin
    - ↳ Can short sell
  - ↳ Expenses lower relative to MF but brokerage fees needs to be paid.
  - ↳ Unlike MF, ETF do not have capital gains distn.

Fund sponsor identifies basket of shares & approaches institut investors
- ↳ Inv. buys shares & deposits w/ fund sponsor
  - ↳ Inv. receives creat units which typically represent 50,000 to 1,00,000 ETF Shares
    - ↳ Shares sold to public by inst inv.

Separately Managed Accts

- Also called 'managed acct', 'wrap acct', 'individually mnged acct'.
- Investor owns individual (underlying) shares
- Tax implications are considered when buying or selling
- Requires high minimum investment



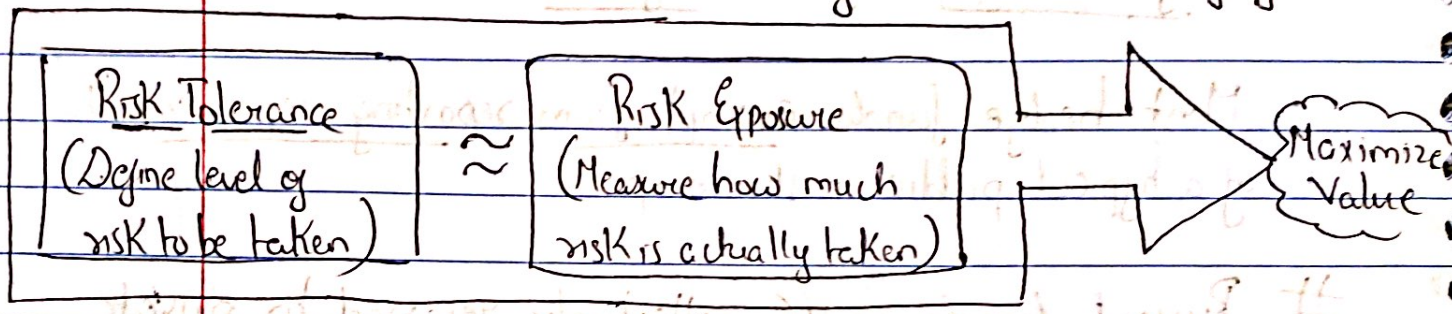
Hedge funds

- Started out as hedge against long-only stock posit^{n};
- High use leverage → High risk
- Most hedge funds exempt from reporting requirements of a typical public invst comp
- # Buyout funds & VC collectively referred to private equity
- Privately held & actively managed
- Buyout funds → Few large invst in established pvt companies
- VC → Small invst in startup companies

Reading 89: PM Risk Management: Introduct°

* Risk Mngmt Process

- Risk is exposure to uncertainty
- Risk exposure
  - ↳ How sensitive an ∈ entity is to the underlying risk



- Minimizing risk is not the goal
- Risk mngmt
  - ↳ Process by which org. or individual degree level of risk to be taken, measures the level of risk being taken, adjusts the latter toward the former, w/ the goal of maximizing company's or portfolio's value or individual's overall satisfact° or utility

Risk Mngmt Framework

- It is the infra, processes & analysis needed to support effective risk mngmt.

• Risk mngmt in case of individuals → max utility while bearing tolerable level of risk

It includes

↳ Risk governance (Helps set risk tolerance, provides overall context for the risk mngmt)

↳ Risk identificat & measurement (quant. & qualitative measures of risk & its exposures)

↳ Risk infra. (ppl, process & systems req. to track risk profile)

↳ Defined polices & processes (Extension of risk gov. to day to day op^s & decision making)

↳ Risk monitoring, mitigat & mngmt (Helps bring risk tolerance = risk exposure)

↳ Communicat (risk reporting & feedback loops)

↳ Strategic analysis & integrat (Helps ↑ perf.)

* Risk governance

Enterprise view of risk gov

Risk tolerance → Risk budgeting → Risk exposure

- Risk gov is a top-down process that defines risk tolerance & provides guidance to align risk w/ enterprise goals; includes guidance on unacceptable & worst losses that can be tolerated
- An enterprise risk mngmt deals w/ whole org.
  - ↳ Determine organizat goals, direct & priorities
  - ↳ Define risk tolerance
  - ↳ Ensure value of entire enterprise is maximized
- Risk governance committee
  - ↳ Interprets obj. & determines how to exec
  - ↳ Ensure risk fmwrk of org stays consistent
  - ↳ Operat level
- Chief Risk Officer (CRO)
  - ↳ Building & implementing RM fmwrk

Risk Tolerance

- Extent to which org is willing to experience losses.
- Focuses on apetite of risk.
- Involves defining:
  - ↳ Inside view :- What shortfalls within org will cause it to fail?

↳ Outside view :- What uncertain forces is org. exposed to?

- Ability to respond dynamically to adverse events may allow for relatively high level of risk tolerance
- Once risk tolerance determined, the overall risk framework should be geared toward getting the risk exposure in line w/ enterprise's risk apetite

Risk budgeting

- Helps determine how & where risks are taken & quantifies tolerable risks by specific metrics ; risk budgeting should drive hedging strategies (not the other way round)
- Allocates investments or assets by their risk characteristics
- Can involve simple, one-dimensional risk measure
  - ↳ Eg. beta, VaR, σ
  - ↳ Eg Limiting beta to 1
- Can also use multiple dimensions
- Forces firm to consider risk tradeoff

Identificat° of Risks

Financial Risks

- Originate from fin. mkt. This includes Δ prices & Δ rates
- 3 primary types of fin. risk are:
  - ↳ Market risk :- Arises from movements in stock prices, interest rates, exch. rates & commodity prices
  - ↳ Credit risk :- Risk that a counterparty will not pay an amount owned
  - ↳ Liquidity risk :- Risk that, as a result of degradat° in mkt condit° or lack of mkt particip°, one will be unable to sell an asset w/o lowering price to less than fundamental value

Non-financial risk

- Operational risk
  - ↳ Arises from within the ops of org. & includes

human & system errors.

- Solvency risk
  - ↳ Risk that an entity does not survive or succeed because it runs out of cash to meet its fin. obligat°

- Other non-financial risks include:
  - ↳ Settlement risk
  - ↳ Legal risk
  - ↳ Regulatory } → Compliance risk
  - ↳ Accounting }
  - ↳ Tax
  - ↳ Model risk
  - ↳ Tail risk
  - ↳ Sovereign or political risk
  - ↳ Health risk
  - ↳ Mortality or longevity risk
  - ↳ Property & casualty risk.

Interact bt Risks

- Many risks arise as a result of other risks
  - MKT risk → Credit risk
  - Credit risk → Settlement risk

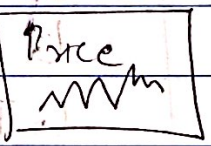
- Risk interact^{n} can be non-linear & harmful
  ↳ Total risk faced is worse than the sum of risks of separate components

- For individuals consider mkt risk & human capital risk

✳ Measuring & Modifying Risks

Drivers

- Base drivers of risk arise from
  ↳ Global macroeconomics
  ↳ Domestic macroeconomics
  ↳ Industries
  ↳ Individual companies



- Risk mngmt can control some risk but not all risk.

- For risks that cannot be controlled, an entity must ensure that its risk exposure is aligned with its objective & risk tolerance.

Metrics

- Probability
  - ↳ Eg. 25% prob. of loss
- σ, volatility
  - ↳ Also called total risk (syst & non-syst risk)
- Beta or durat^n
  - ↳ Measures only syst. risk
  - ↳ Measure of risk relative to market
  - ↳ For stocks → beta
    bonds / fixed inc → durat^n
- Derivative measures
  - ↳ Delta (Sensitivity of opt^n price to changes in underly assets price)
    - ↳ Gamma (Sens. of opt^n wrt delta) — useful for small changes
    - ↳ Vega (Sens of opt^n wrt underlying volatility) — for large changes
    - ↳ Rho (..... wrt int rate)
- VaR & CVaR
  - ↳ Eg If portfolio val is $200 mil & VaR is $3 million at 5% for one day i.e. can lose minimum 3 mil in 1 day 5% of the times

↳ Conditional VaR (CVaR) tells us what happens if the loss is worse than 3 mil. It gives us the weighted avg of loss outcomes in a dist that exceeds VaR loss

↳ Stress testing (Complements VaR)

↳ If X happens, how are we impacted

↳ Scenario analysis (Complements VaR)

↳ Combinat of stress testing

Methods of Risk Modificat

- Risk prevention & avoidance

- Risk acceptance

↳ Self-insurance (If risk > tolerance level, comp will set aside some funds in order to deal w/ extra risk) Eg. banks

↳ Diversificat

- Risk transfer

↳ Process of passing risk to another party eg. insurance policy. Insurance policy will not accept risk that cannot be diversified away

- Risk shifting
  - ↳ Actions that change distⁿ of risk outcomes
  - eg. derivatives < forward contracts: fwd cont., futures, swaps
    contingent claims: optⁿ

- How to choose which Method for Modifying Risk
  - ↳ Consider cost & benefit of each optⁿ in light of risk tol. of entity
  - ↳ Self-insure where it makes sense & diversify to extent possible
  - ↳ Insure (risk transfer) when risks can be pooled effectively; compare cost of insurance w/ expected benefit

Reading 39: PM Portfolio Risk & Return 1

* Invst. characteristics of assets

*# Return

- Return can come in 2 forms:
  - ↳ Income (int. pmts as dividends)
  - ↳ Capital gains

- Holding Period return

- Arithmetic Mean Return

[A] [B] [C]

$$\frac{10\% + 20\% + 30\%}{3} = 20\%$$

- Geometric mean return

[A]

$$GM = (1.1 \times 1.2 \times 1.3)^{1/3}$$

10% (2010) 20% (2011) 30% (2012)

- Money weighted return / IRR

Eg. Computation of returns.

Year	AUM at start of the yr	Net Return
1	30	10%
2	33	-5%
3	35	15%

→ HPR = $(1.1 \times 0.95 \times 1.15) - 1$

Arithmetic mean = $\frac{10 - 5 + 15}{3}$

GM :- $(1.1 \times 0.95 \times 1.15)^{1/3} - 1$

Money wt return

	1	2	3
Bal. from prev yr	0	33	31.35
New inst by inv.	30 (given)	0	35 - 31.65 = 3.65
Withdrawal by inv.	0	0	0
Net bal @ start of the yr	(30)	(33)	(35.00)
Investment return for yr	(10%)	(-5%)	(15%)
Investment gain (loss)	3	-1.65	5.25
Bal. @ end of yrs	33	31.35	40.25

CF0 = -30, CF1 = 0, CF2 = -3.65, CF4 = 40.25

→ IRR = 6.62%

- **Annualized Return**
  - Eg. if ~~retur~~ 20-day return is 2%. Then annualized is $(1.02)^{\frac{365}{20}} - 1 = 43.53\%$.

- **Portfolio Return**
  - Eg.

Security	wt	return	
A	0.5	× 20%	+
B	0.25	× 10%	+ = 22.5%
C	0.25	× 40%	

A
100 → 120
20% →
(2%)
18%
If 33.33% tax rate
12%

- **Gross return**
  - Return earned by asset mngr prior to deducting mngmt fees & taxes; measures investment skill

- **Net return**
  - Accounts for managerial & admin. expenses; this is what inv. is concerned about

- **Pre-tax nominal return**
  - Return before tax & inflat; default rate

- **After-tax nominal return**
  - Return after tax, $r_{at} = r_{pt}(1 - \text{Tax rate})$

- **Real return**
  - ↳ Return after considering inflation & taxes

$$(1 + r_{AT}) = (1 + rr)(1 + \text{inflation rate})$$

- **Leveraged buyout return**

Variance & Covariance of Returns

- **Variance or risk** → measure of volatility of dispersion
  - ↳ Avg sq. deviation from the mean.

- Eg. annual returns data 10%, -5%, 10%, 25%.
  What is the population & sample std. deviation?

→

$$\sigma^2 = \frac{\sum_{i=1}^{N} (R_i - M)^2}{N} \qquad s^2 = \frac{\sum_{i=1}^{N} (R_i - \bar{R})}{N-1}$$

<USE CALCULATOR TO CAL. VAR>

- **Covariance**
  - ↳ Measure of how 2 variables move together
  - ↳ Range -∞ to ∞
  - ↳ Difficult to interpret

- Wt equally-wt portfolio made up of large no. of assets, which of the following contributes the most to volatility?
  ↳ Avg. covariance bt all pairs of assets

- Correlation
  ↳ Standardized measure of linear relat bt 2 variables w/ values ranging bt -1 & +1

Covariance $= \frac{\sum (x_i - x_{avg})(y_i - y_{avg})}{n-1}$

$$Cov(R_i, R_j) = \rho(R_i, R_j) \cdot \sigma(R_i) \cdot \sigma(R_j)$$

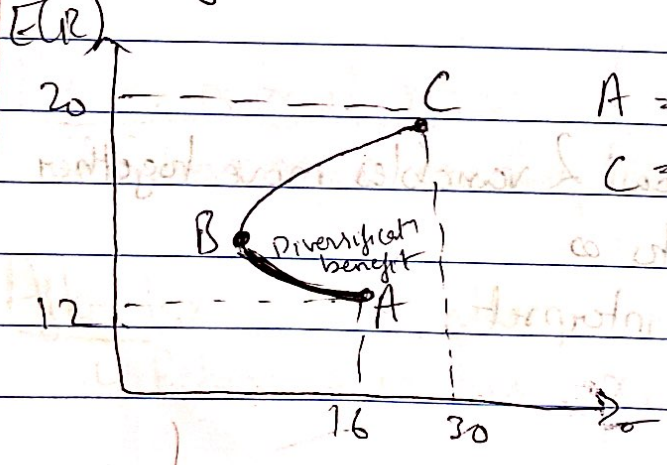
Eg. Consider Portfolio consists of A w/ 60% wt, 12% return & 16% σ & B w/ 40% wt, 20% return & 30% σ. $\rho = 0.5$

$$E(R_p) = w_A R_A + w_B R_B$$

Exp. Ret of portfolio

$$\sigma^2(R_p) = w_A^2 \sigma_A^2 + w_B^2 \sigma_B^2 + 2 \sigma_A \sigma_B w_A w_B \rho$$

- So if you keep changing wt of A & B you get something like:



- Adding a stock to a portfolio will reduce the risk of portfolio if β is < 1 & not 0

Characteristics of Major Asset Classes

	Annual Avg. Return	σ
Small-cap stks	Highest	Highest
Large-cap stks		
Long-trm corp bonds		
Long-trm T bonds		
T-bills	Lowest	Lowest

Other characteristics

Assumption 1:
Returns are normally distributed

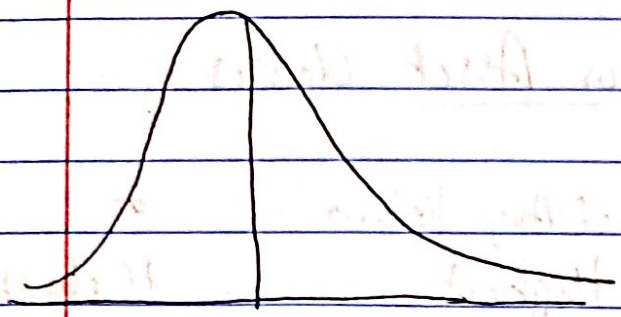
If assumpt does not hold then consider
- ↳ Skewness
- ↳ Kurtosis

Assumpt 2:
- MKTs are informationally & operationally effluent
- If mkts are not op^ effi, we have liq. issue
  - ↳ Wide spreads
  - ↳ Price impact of trades

- **Skewness**
  - ↳ Extent to which dist is not symmetric
  - Normal dist has skew = 0

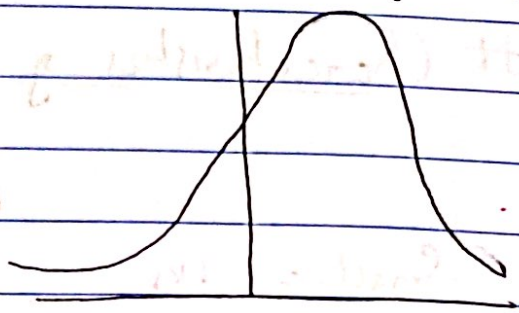
* Analyst observes stk mkts usually demonstr return distn concentrated to right of higher freq of -ve deviat from mean. This feature is → -ve skewness

+ve skewed / Right



Mean > Med > Mode

-ve skewed / Left



Mode > Med > Mean

- Kurtosis
  - ↳ More or less peaked
    - ↳ K = 3 → MesoKurtic (Normal)
    - ← K > 3 → LeptoKurtic (More peaked, fatter tails, ↑ extreme outliers) ↑ Risk
    - K < 3 → PlatyKurtic (Less peaked)

* Risk Aversion & Portfolio Selection

Concept of Risk Aversion

- Refers to behavior of investor of preferring less risk to more risk.
- High risk aversion is same as low risk aversion
- Risk profiles
  - ↳ Risk Seeking

- The most risk averse inv. has indiff curve with greatest slope

↳ Risk Neutral
↳ Risk Averse

Utility theory & Indifference curve

- Utility of invst tells us how happy the investor is

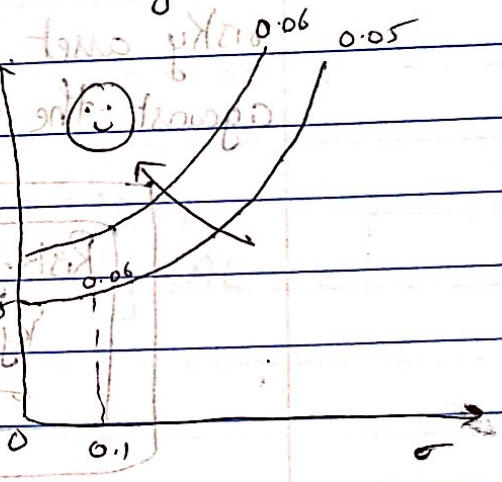
$$\text{Utility of an invst} = E(r) - \frac{1}{2} A^* \sigma^2$$

A is measure of risk aversion

- Do all calc. in decimals.

- An inv. w/ A = 2 owns a risk free asset returning 5%, what is his utility?
↳ 0.05 - 0 = 0.05

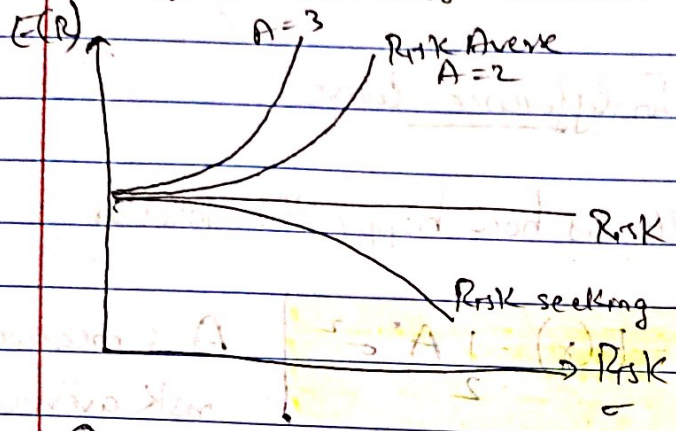
- He is considering an asset w/ σ = 10%.
At what level of return will have same return utility? → $0.05 = x - \frac{1}{2} \times 2 \times 0.1^2$
$x = 0.06$



- Given a choice b/t risk free asset & stock w/ E(r) = 10% & σ = 20. What will he prefer?
→ Risk free utility = 0.05
w/ risk = $0.1 - \frac{1}{2} \times 2 \times 0.2^2 = 0.06$ → prefer this.

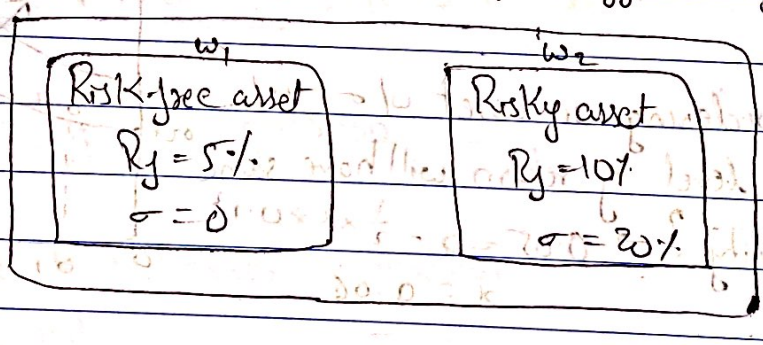
Optimal portfolio for inv w/ lower coeff. of risk aversion will have higher level of risk & return relative to optimal port of more risk averse

- Indifference curve for various types of investors



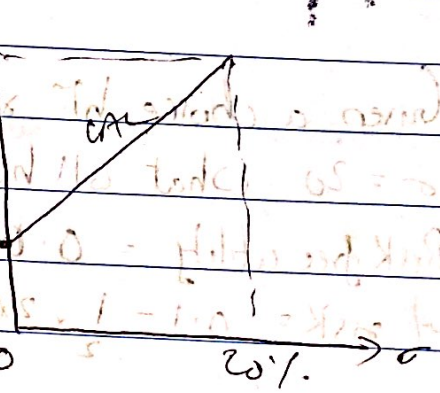
Capital Allocat" Line

- For diff. comb" of wts, cal. σ & E(r)
- Consider a simple portfolio of risk-free asset & risky asset. Plot the expected return of portfolio against the risk of portfolio for diff wts of 2 assets



For

w_1	w_2	σ_p	R_p
1	0	0	5%
0.75	0.25	5%	6.25%
0.5	0.5	10%	10%
0	1		

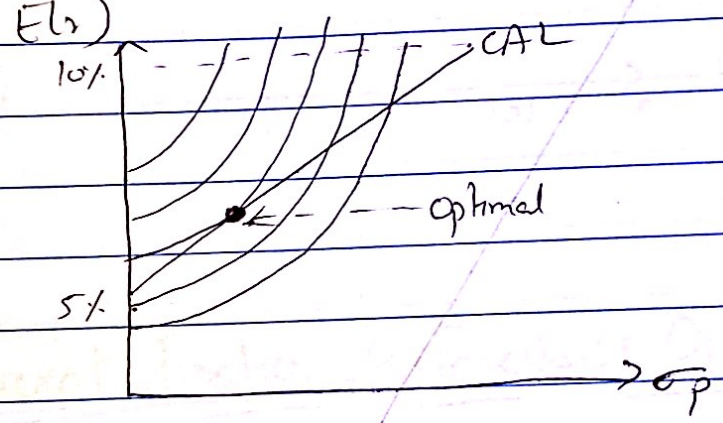


$$y = mx + c$$

$$R_i = \frac{R_i - R_f}{\sigma_i} \cdot \sigma_i + R_f$$

R_i

- What is the optimal portfolio?
  - ↳ Consider CAL & inv. indifference curve to identify to the optimal portfolio



If another inv. has ↑ level of risk aversion, the optimal portfolio will lie on the left of CAL

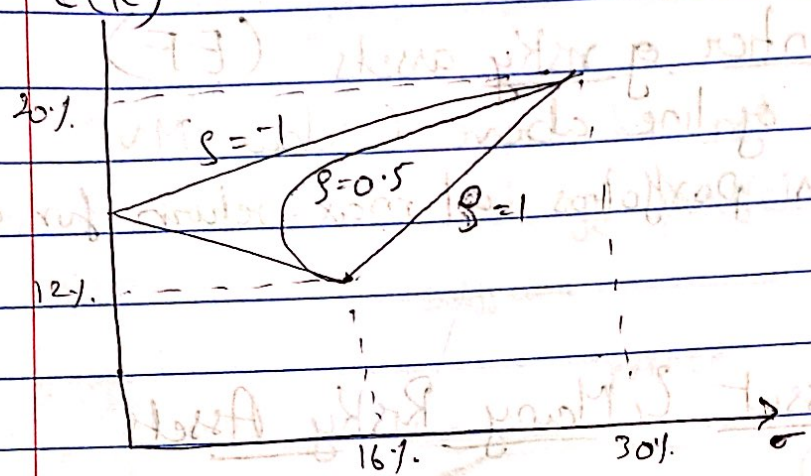
✕ Portfolio Risk

- Depends on
  - ↳ Risk of individual assets
  - ↳ Wt of each asset
  - ↳ Covariance or correlat bt^n assets

As correlat ↓, risk ↓

. Compared to effcient frontier, dominant cap. allocatn line has > rates of return for levels of risk > than optimal risky port cos of inv. ability to borrow @ risk free rate

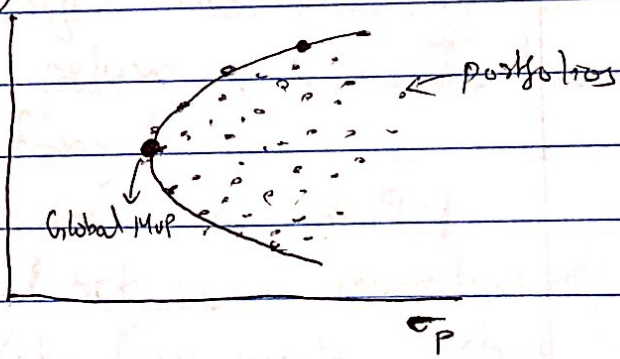
- Relationship btr risk & return when changing wts & correlatn



Efficient Frontier & Investor's Optimal Portfolio

Invst Opp. Set & Minimum Variance Portfolios

- Consider universe of risky, investable assets. These can be combined to create many portfolios. This set of portfolios is called invst opp. set



- Min. Var Portfolios (MVP)
  - ↳ For every return, portfolios w/ minimum var. are connected by a line called MVP

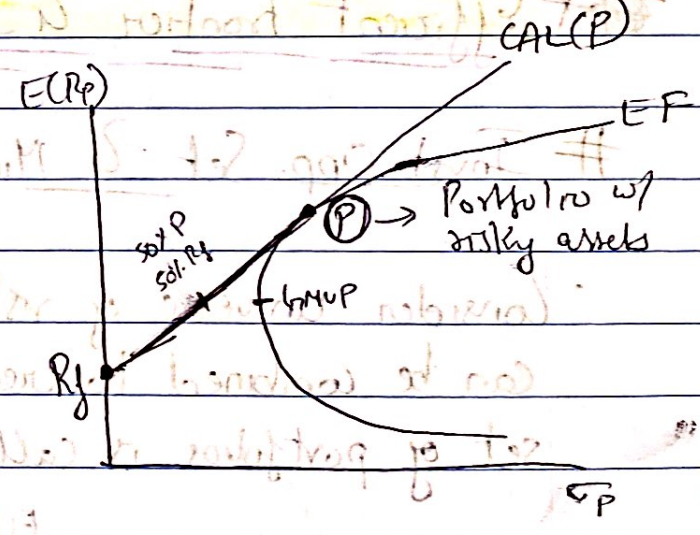
- Global MVP
  ↳ Portfolio w/ minimum lowest variance

- Efficient frontier of risky assets (EF)
  ↳ Portion of line above Global MVP
  ↳ It gives portfolios w/ max. return for a given σ.

Risk free Asset & Many Risky Assets

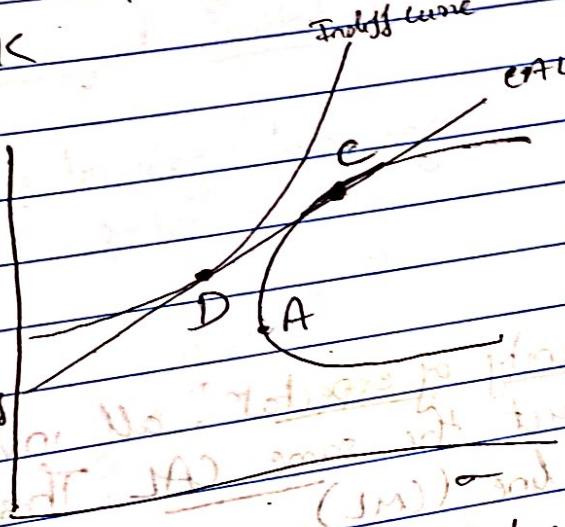
- Addition of risk free asset makes invst opportunity set much richer than only having risky assets

P → Optimal Risky portfolio



Optimal Inv. Portfolio

- We must use indifference curves
- CAL(P) is based on mkt, not investor
  - ↳ Represents most eff. portfolio for each level of risk



C → Best comb^n of risky assets only

D → Best comb^n of risky & risk free

CAL = Risky + Risk free Asset

CML = MKt portfolio + Risk free Asset

Q. An invst has uncertainty ie 50% prob of 12% returns & 50% prob of 6% ret. An inv. prefers this uncertain risk averse, neutral, seeking? as compared to guaranteed return of 10%. Is he

↳ E(R) = 0.5 x 0.12 + 0.5 x 0.06 = 9%

E(R) < guaranteed ret sc. inv must be risk seeking

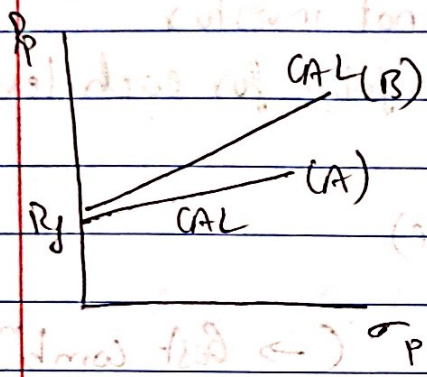
even if E(P) = guaranteed ret & he chooses uncertain one → risk seeking

☆ Conceptual questions & remember remember all graphs

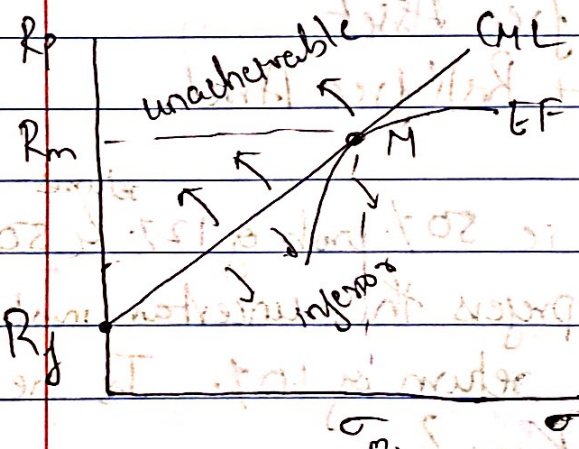
Reading 40: PM Portfolio Risk & Return Part 2

✳ Capital Market Theory (CAL)

Inv have diff views of the mkt → Diff optimal risky portfolio → Diff capital allocat lines



- **CML**
  - ↳ Assuming 'homogenity of expectat', all investmnt advisors will construct the same CAL. This is called capital mkt line (CML)



$$y = mx + c$$

$$R_p = \left[\frac{R_m - R_f}{\sigma_m}\right]\sigma_p + R_f$$

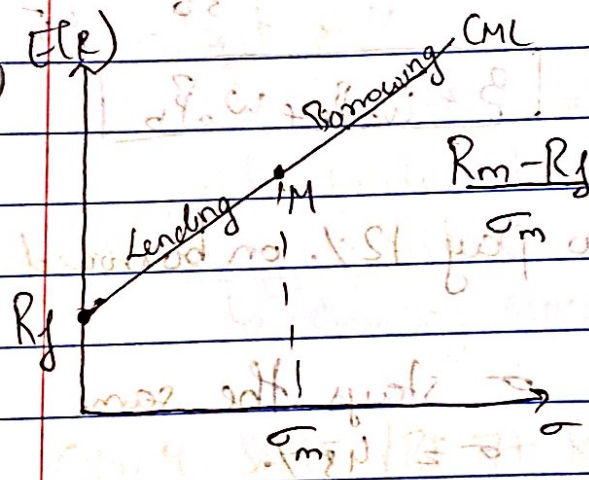
Consists of all risky assets

- CML is a special case of CAL where efficient portfolio is the mkt portfolio

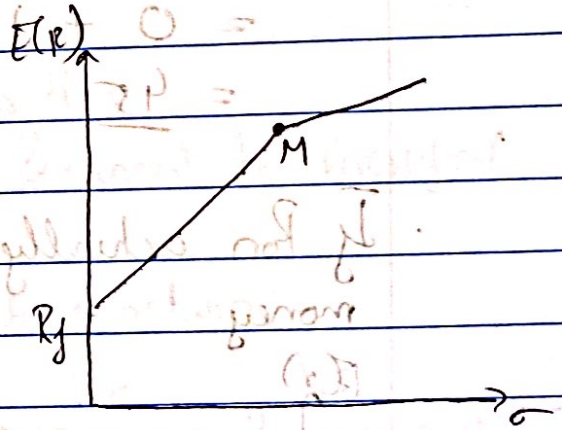
- What is 'market'?
  - ↳ Includes all risky assets
  - ↳ MKt portfolio shd contain only as many assets as possible but it is not practical to include all assets in single risky portfolio

Leveraged Portfolios

Same lending & borrowing rates



Diff. lending & borrowing rates



$$\text{Slope} = \frac{R_m - R_{Borrowing}}{\sigma_m}$$

Eg. After successful initial foray, Ron gets little greedy & decides to build leveraged portfolio. He invests $100,000 of his own money & $50,000 of borrowed. He expects to pay 10% on borrowed money

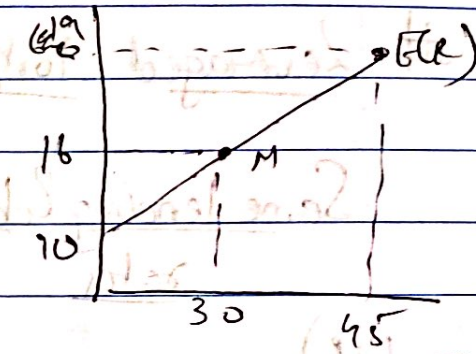
The indx fund has an expected return of 16%. & σ 30%. Cal. E(r) & σ

→ $w_1 = -0.5 \left(\frac{50000}{100,000}\right)$

$w_2 = 1.5 \left(\frac{100,000+50000}{100,000}\right)$

$E(R_p) = -0.5 \times 10 + 1.5 \times 16$

$= \underline{19}$



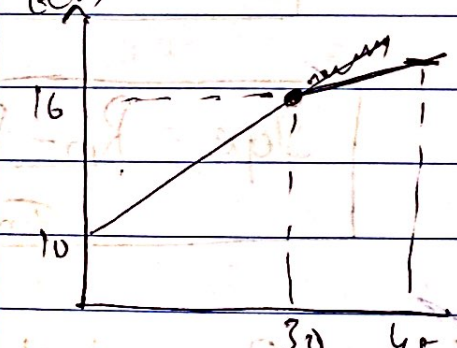
$\sigma_p = \sigma_f \cdot w_f + w_2 \cdot R\sigma_2$

$= 0 + 1.5 \times 30$

$= \underline{45}$

$\boxed{\beta = w_a \beta_a + w_b \beta_b}$

If Ron actually has to pay 12% on borrowed money



σ stays the same

σ = 45%.

$\Delta y = \Delta x \times \text{slope}$

$= (45-30) \cdot \frac{R_m - R_f}{\sigma_m}$

$= 15 \times \frac{16-12}{30} = 2$

$E(R_p) = 16+2 = 18\%$

✗ Pricing of Risk & Computation of Expected Return

- Systematic & Non-systematic risk
  - ↳ For ↑ returns, you need to take ↑ risks
  - ↳ But does all ↑ risk lead to ↑ returns? NO
  - ↳ Total variance = Systematic + Non-systematic risk
  - ↳ Non-syst. risk # $\sigma_i^2 = \beta_i^2 \sigma_m^2 + \sigma_e^2$ (syst var + non syst var)
    - ↳ No compensation
    - ↳ Local & can be diversified
  - ↳ Syst. risk
    - ↳ Inv. get a return for this
    - ↳ Affects entire economy & cannot be diversified
  - ↳ Pricing of risk
    - ↳ Estimating expected rate of return

ONLY SYST. / BETA RISK IS PRICED & EARNS A RETURN.

- Examples of syst & non-syst risk
  - ↳ Describe syst & non-syst risk component of following assets
    - ↳ 6-month T-bill (SR=0, NSR=0)
    - ↳ Index fund based on S&P 500, w/ total risk 18%. (SR=18%, NSR=0)

↳ Consider 2 assets X & Y. X has total risk of 25% of which 15% is SR. Asset Y is S&P index fund w/ total risk of 18% viz. SR.
Which asset will have higher expected rate of return?

↳ → X : SR = 15% Y : SR = 18%
NSR = 10% NSR = 0%

Only compare SR w/s. NSR can be diversified away.

So 18 > 15 ∴ Y will have higher return.

Return Generating Models

Provides estimate of expected return of security given certain parameters.

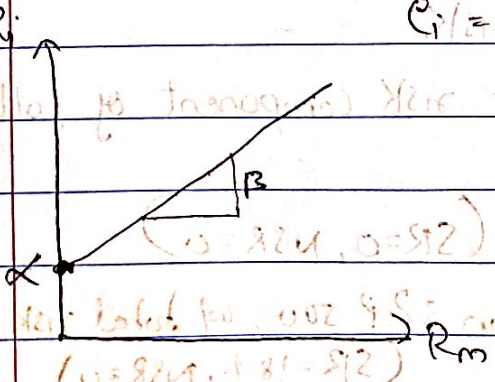
- Market Model

$$R_i = \alpha_i + \beta R_m + e_i$$

where α_i = intercept

β = S.R

e_i = security specific return



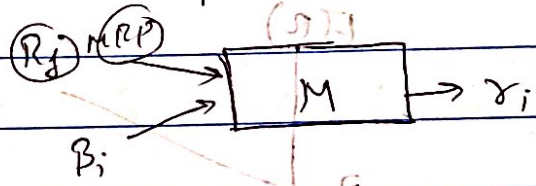
Calculat & Interpretat of Beta

- Beta is SR & tells us how sensitive an asset's return is to mkt as a whole

$$\beta_i = \frac{\text{Covariance of return on } i \text{ \& on mkt}}{\text{Variance of mkt return}} = \rho \frac{\sigma_i}{\sigma_m}$$

Capital Asset Prizing Model (CAPM)

- CAPM: exp. returns are based on systematic risk



If CAPM rate > Exp. Rate → Overprice

$$r_e = R_f + \beta [E(R_{mkt}) - R_f]$$

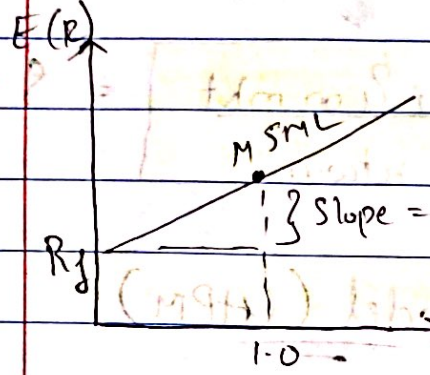
Avg $\beta = 1$

CAPM Assumptn

- Inv. are risk averse, utility max. & rational
- Frictionless mkt
- Single holding period
- Homogenous expectat (i.e all have same optimal risky portf.)
- Invst are divisible
- Inv. are price takers
- Security prices are not affected by inv. trades

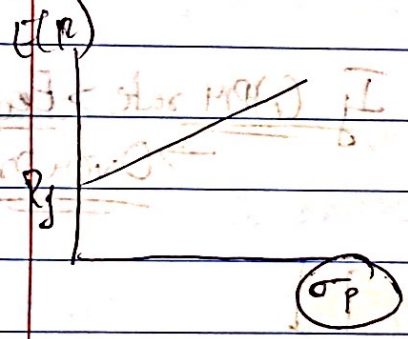
Security MKt line (SML)

- Graphical representation of CAPM & applies to all securities, wether or not they are efficient

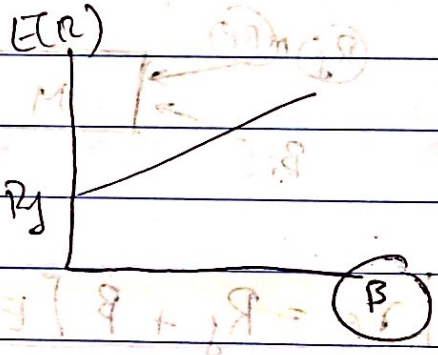


$$r_i = r_f + \beta (r_m - r_f)$$

CML



SML



- Slope = Sharpe Ratio
- Applies to efficient port.
- Uses total risk

Slope = Risk premium

Applies to any security

Uses systematic risk

Eg. Ricky ponting invests 10% in risk free asset, 40% in MF that tracks mkt & 50% in stock w/ beta = 2.5. R_f = 5%. & expected mkt return is 10%. What is portfolio beta & exp. return?

→

R_f	$w = 0.1$	$r = 5\%$	$\beta = 0$
M	$w = 0.4$	$r = 10\%$	$\beta = 1$
S	$w = 0.5$	$r = ?$	$\beta = 2.5$

$\therefore \beta = 0.1 \times 0 + 0.4 \times 1 + 0.5 \times 2.5 = 1.65$

$r_p = 5 + 1.65(10 - 5) = 13.25\%$

* Applicat of CAPM

Estimate of Exp. Return

- Given asset's systematic risk, exp ret can be calc using CAPM.
- To estimate price of asset, we discount CF at CAPM rate
- CAPM rate also used for capital budgeting process

Performance Evaluat°

- **Sharpe Ratio**

↳ $\text{Sharpe Ratio} = \dfrac{(R_p - R_f)}{\sigma_p}$

↳ Limitat°

↳ Uses total risk

↳ Ratio itself not informative

- **Treynor Ratio**

↳ $\text{Treynor Ratio} = \dfrac{(R_p - R_f)}{\beta_p}$

↳ Limitat°

↳ Ratio itself not useful

- **M2**

↳ $M^2 = (R_p - R_f)\dfrac{\sigma_m}{\sigma_p} - (R_m - R_f)$

↳ $M^2 = 0$ → Mngr doesn't add value

> 0 → good

↳ Gives ranking similar to Sharpe ratio
↳ Limitation
↳ Uses total risk

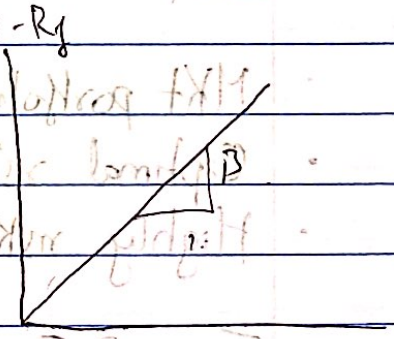
- Jensen's Alpha

↳ $\alpha_p = R_p - [R_f + \beta(R_m - R_f)]$
↳ Gives ranking similar to treynor ratio
↳ Best one
↳ Describes intercept of best line formed by plotting

Security Characteristic Line (SCL) $R_i - R_f$ vs $R_m - R_f$

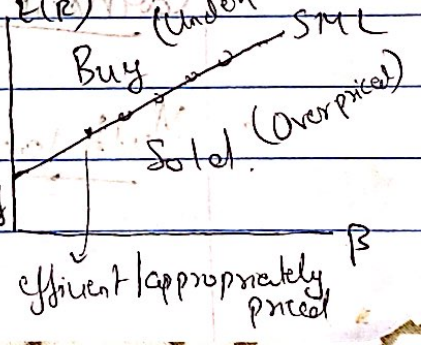
- SCL is plot of excess return of a security on excess return of mkt

★ $R_i - R_f = \alpha + \beta(R_m - R_f)$



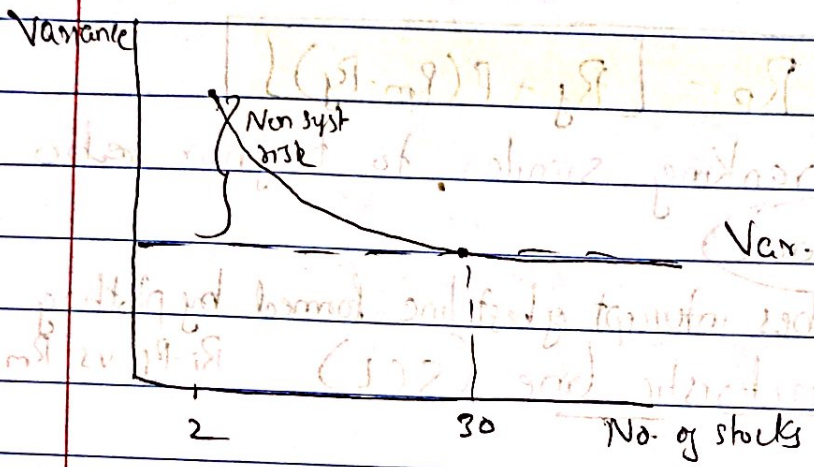
Security Selection

- SML can be used for security selection



Constructing Portfolio

- Holding as few as 30 stocks can diversify away syst' nonsyst. risk (Shd have low (-ve) correlatn)



Kaplan

- MKt portfolio → all risky assets
- Optimal risky portfolio → mkt portfolio
- Highly risk averse will invest in risk free assets

∴ Fama & French multifactor model: E(r) is explained by firm size, book-to-mkt, excess return
Carhart model added price momentum as 4th

- Multi-factor models

↳ Statistical

↳ Statistical factor model

↳ Use historical & cross-sect data to identify factors that explain var or cov

↳ Macroeconomic factor

↳ Use eco factors correlated w/ returns like eco growth, int rate, inflat rate

↳ Fundamental factor

↳ Use underlying factors like earnings, earnings growth, CF generat°, invst in research

Reading 41: Portfolio Planning & Construction

* Portfolio Planning

- Program developed in adv. of const a portfolio that is expected to satisfy client's invst. obj.
- Written document governing this process → Invst policy stat (IPS)
- It defines plan for invst. success given clients situat & req. The IPS can be reviewed on regular basis but need not be explicitly mentioned in IPS
- Major Components of IPS
  - ↳ Intro: Describes client
  - ↳ Stat. of Purpose: States purpose of IPS
  - ↳ Stat. of duties & responsibilities: D&R of client, custodian etc
  - * ↳ Procedure: Steps to take to keep IPS current & proc to follow to respond to contingencies
  - ↳ Invst. objectives: Clients obj in invst
  - ↳ Invst constraint: Factors that constrain the client
  - ↳ Invst. guidelines: How policy shd be exec & specific type of asset
  - ↳ Evaluat & review
  - * ↳ Appendices: SAA & rebalancing policy

Risk Objectives

- Specificat for portfolio risk that reflect risk tolerance of client

- Org. risk tolerance most likely reflects its competitive pos^n

- Overall risk tolerance depends on ability & willingness to take risk
  - ↳ Ability (Based on wealth, time horizon, income etc)
  - ↳ Willingness (More subjective & based on psychology)

- Risk tolerance can be expressed qualitatively as high, medium, low.

- Quantitative risk
  - ↳ Absolute term
    - ↳ Portfolio shd not suffer > 5% loss in any 12 month period
  - ↳ Practical term - With 95% probab., portfolio shd not lose > 5% val. in any 12 month period
  - ↳ Relative term
    - ↳ Return shd be within 4% of S&P500 return

Eg. Jack Kallis

Salary → ↑
Owns his house
Secure job
} Ability ↑ + → High Risk tolerance

Knowledge abt fin.
Confident abt eq. mkt
} Willingness ↑

Return Objectives

- Absl
- Absolute term
  ↳ Client wants to achieve a particular return. Return of 9% or inflat adjusted (real) return of 2%.
- Relative term
  ↳ Return 3% > than 12-month LIBOR

Return

- Requirement can be stated before or after fees
- Stated risk & return must be compatible

No. need to see this <Example 4 from Curriculum or IFT Video Eg>

Investment Constraints

- Time Horizon
  ↳ Period during which portfolio is accumulating before assets needs to be withdrawn.
  ↳ Eg. Frank is investing for retirement & has 20-yr horizon. He has average tolerance. Which invt is least likely suitable?
  (a) Listed equities (b) Pvt equity (c) T-bill

↳ Eg. Al wants to pay a large bill in 6 months & wants to invst. Which invst o likely to be least suitable?
(a) Listed eq. (b) Put eq. (c) T-bills
(more risk)

- Tax Concerns
  ↳ Tax status varies from inv to inv. & must be considered when evaluating portfolio.

- Liquidity
  ↳ Requirement related to withdrawing funds from portfolio

- Legal & Regulatory

- Unique Circumstances
  ↳ Eg. not investing in the same ind he works in or not investing in alchol., firearms etc

Gathering Client informatn

- Imp to Know their clients
  ↳ Family situatn
  ↳ Employment situatn
  ↳ Financial informatn

* Portfolio Construction

Define IPS → Construct Portfolio

Strategic Asset Allocat (SAA)

↓

Tactical Asset Allocat

↓

Security Selectn

Capital MKt Expectat & SAA

Inv. specifies

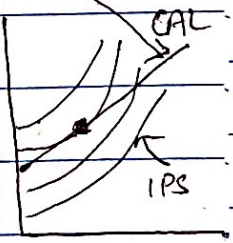
Invest Obj. & Const. (IPS) + Long-term Capital MKt Expectat

↓

Optimizat / Simulat

↓

Strategic Asset Allocatn



time,

- With, asset allocat will dryt from target allocat.
- Amt of allowable dryt & rebalancing policy should be defined.
- SAA & rebalancing policy are generally in IPS appendix.
- When defining SAA, it is imp to consider asset class correlat matrix.

Asset class :- Category of assets w/ similar characteristics

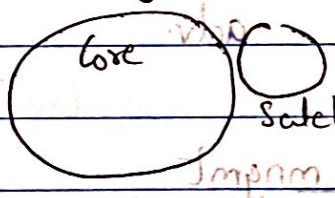
- Tactical Asset Allocat
  - ↳ Changing the asset allocat for a short period of time [Deliberately deviate from policy exposures to suff. risk w/ intend to add val. based on forecasts]
- SAA is means of providing inv. w/ exposure to systematic risks of asset classes in proport. that meet the risk & return objectives. It drives significant % of overall return
- Risk budgeting
  - ↳ Process of deciding on the amt of risk to assume in portfolio & subdividing it among sources of invst return

↳ Forces trade risk trade offs accross organizat°

- Passive Investing
  ↳ Simply investing in mkt like in S&P 500

- Active Investing
  ↳ Looking for undervalued stock

- Core - satellite approach
  ↳ Divide your portfolio in 2 parts : Core & satellite
  ↳ Core is managed by passive strategy
  ↳ Satellite is investing in undervalued stk (active)



Reading 42: Fintech in Invst Mngmt

✳ What is Fintech?

- Technological innovat° in design & delivery of fin. prods & services
- Evolut° of fintech
  - ↳ Data processing & automation → Decision making applicat°
- Drivers of fintech: Rapid ↑ in data & technological adv.
- Fintech in invst mngmt
  - ↳ Analyses of large data set
  - ↳ Analytical tools
  - ↳ Automate trading
  - ↳ Automated device
  - ↳ Financial record keeping

✳ Big Data

- Vast amt of data generated by indstry, gov. & individuals
- Characteristics of big data
  - ↳ Volume ↳ Velocity ↳ Variety

- Traditional data : Data from stk mkt; vol: , fin. reports
- Alternate data

Individuals	Bus. process	Sensors
Social media	Transactn &	Satellites
news	comp. data	Geolocatn
reviews		IoT
web searches		other
personal data		

- Big data challenges
  - ↳ Not enough vol
  - ↳ Biases

Advanced Analytical Tools: AI & ML

- AI
  - ↳ Computer systems perform tasks that traditionally req human intelligence
  - ↳ They exhibit cognitive & decision making capability superior to humans
- ML
  - ↳ learn how to complete tasks or predict outcomes

- ML approaches
  - ↳ identify relat bt variables
  - ↳ detect patterns
  - ↳ create struct from data

- 2 ML approaches
  - ↳ Supervised
  - ↳ Unsupervised

* Data Science :- Extracting info from Big Data

- Leverages adv. in comp. sci, statistics & other disciplines to extract info from big data

- Data Processing Methods
  - ↳ Capture : Data collect & transformat
  - ↳ Curat : Data cleaning
  - ↳ Storage :- Whether data is structured or not or whether analytical needs low latency
  - ↳ Search : How to query data
  - ↳ Transfer : How data will move from underlying data source to underlying analytical tool

* Applications of FinTech in Invst Mngmt

Text analytics & NLP

- Text analytics
  - ↳ Derive meaning from large, unstructured data or voice-based data

- NLP
  - ↳ Applicat^ of text analytics whereby computers analyse & interpret human language

Robo-Advisory Services

- Invst sol^ through online platforms
  - ↳ Asset allocat^
  - ↳ Rebalancing
  - ↳ Tax strategies
  - ↳ Trade execut^

- Low cost & low acct minimums

- Cover both active & passive, mostly passive

- Major types
  - ↳ Fully automated digital wealth mngrs
  - ↳ Advisor-assisted

- Robo-advice has its limits

Risk Analysis

- Stress testing & risk assessment involves vast amt of risk data

- ↑ interest in monitoring real time risk

- Bigdata & ML can provide insights into changing mkt condn

- Assess data quality

- Scenario analysis

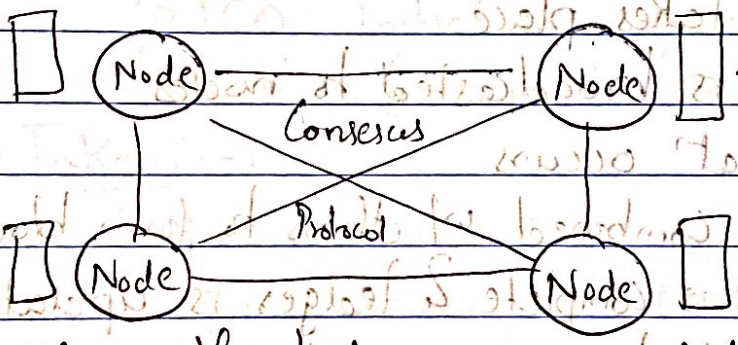
Algorithmic trading

- Computerized trading based on pre-specified rule
  - ↳ When, where & how to trade

- ↑ used because of ↑ in trading dest^n
- Large orders sliced into smaller pieces & executed across diff exchanges
- Benefits :- speed of exec., anonymity, ↓ trans. cost

Distributed Ledger Technology

- Dist Ledger → database that can be shared across computer entities in a ntwk



- Records in the ledger are immutable
- DLT uses cryptography (Uses encrypt^n so that data remains secure)
- Smart contracts
  - ↳ Computer prog that self exec on basis of pre-specified terms & cond^n
- DLT ntwks allows us to create, exchange & track ownership of fin assets on peer-to-peer basis
- DLT benefits
  - ↳ Acc., transp. & security
  - ↳ Faster transfer of ownership

↳ Peer-to-peer interact^{n}

- Blockchain is a type of DLT
  - ↳ Info recorded sequentially in blocks
  - ↳ Blocks are chained & secured using crypto
  - ↳ Each blk contain grouping of trans: & secure link to prev. blk

- Adding transact^{n} to Blockchain
  1. Trans. takes place
  2. Trans. is broadcasted to nodes
  3. Validat^{n} occurs
  4. Trans. combined w/ others to form blocks
  5. Trans is complete & ledger is updated

Once added, trans is considered immutable (cannot be changed)

Permissionless Ntwks
- ↳ Open to all
- ↳ All users can see all trans. on blkchain
- ↳ Does not depend on central autho.

- Permissioned Ntwks
  - ↳ Control might be used
  - ↳ Ntwk members may be restricted from participating in certain ntwk activities

- Applicat of DLT
  - ↳ Cryptocurrency
    - ↳ Issued by pvt comp., no central authority
    - ↳ Max limit for bitcoin: 21 mil
    - ↳ ICO: Initial coin offering (Unregulated)
    - ↳ Lack of fundamental so volatile
  - ↳ Tokenizat°
    - ↳ process of representing ownership rights to assets on dist ledger or blk chain. [If A owns B some money & A defaults, tokenizat° will help B identify assets under A which can be claimed]
  - ↳ Post-trade clearing & settlement
  - ↳ Compliance

- Limitat of DLT
  - ↳ Difficulty in integrat of DLT w/ current sys
  - ↳ Not standardized
  - ↳ Rep vast amt of storage resources
  - ↳ Immutability of trans
  - ↳ Huge computat° power
  - ↳ Regulatory approaches towards crypto can vary from jurisdictions