Taylor Rule Nominal policy rate:	$i^* = r_{\text{neutral}} + \pi_e + 0.5(\hat{Y}_e - \hat{Y}_{\text{trend}}) + 0.5(\pi_e - \pi_{\text{target}})$ Y_e real GDP growth = nominal – inflation π_e
Real target rate	Nominal policy rate – Expected inflation (π_e)
Trade surplus: ~ current account	(X − M) = (S − I) + (T − G).
Grinold-Kroner	$E(R_e) \approx \frac{D}{P} + (\%\Delta E - \%\Delta S) + \%\Delta P/E$
Equity beta, asset i:	$\beta_{i,M} = \frac{\text{Cov}(R_i, R_M)}{\text{Var}(R_M)} = \rho_{i,M}\left(\frac{\sigma_i}{\sigma_M}\right)$
Global risk premium:	$RP_i^G = \beta_{i,GM} RP_{GM} = \rho_{i,GM}\sigma_i\left(\frac{RP_{GM}}{\sigma_{GM}}\right)$
Segmented risk prem: beta = 1	$RP_i^S = 1 \times RP_i^S = 1 \times \sigma_i\left(\frac{RP_i^S}{\sigma_i}\right)$
Singer-Terhaar	$RP_i = \varphi RP_i^G + (1-\varphi) RP_i^S$
Real estate growth rate:	$E(R_{re})$ = Cap rate + NOI growth rate − %ΔCap rate ~ cap rate = value/NOI ~finite horizons
Surplus Optimizer:	$U_m = E(R_m) - 0.005\lambda\sigma_m^2$ m = (ΔA – ΔL)/A_0
Prob. above threshold:	[E(R_P) – $R_{\text{Threshold}}$]/σ_P. *~ derive from percentage*
Risk parity weight:	$w_i \times \text{Cov}(r_i, r_P) = \frac{1}{n}\sigma_P^2$
Marginal CTRisk	$\beta_{i,P} * \sigma_P$ optimal AA when SR = RP/MCTR
Absolute CTRisk	$\text{ACTR}_i = (\text{Weight}_i)(\text{MCTR}_i)$
Fundamental law:	$E(R_A) = IC\sqrt{BR}\,\sigma_{R_A} TC$ — IC forecast ~ actual TC translate /1

Eff. number of stocks:	$= \frac{1}{\sum_{i=1}^{n} w_i^2} = 1/\text{HHI}$
Macaulay duration:	weighted average time of receipt all payments
Modified duration:	Mac D * (1+yield) $^{-1}$ ~ % change in price for a change in ytm
Money duration:	Port mod duration × Port market value BPV: multiply by 0.0001 ~ used for futures
Duration $\text{BPV}_{\text{Exposure}}$: *immunize = 0*	= ($\text{BPV}_{\text{Liability}}$ – $\text{BPV}_{\text{Asset}}$) + ($\text{N}_{\text{Futures}}$ × BPV_{Fut}) ~ $\text{BPV}_{\text{Fut}} = \text{BPV}_{\text{CTD}}/\text{ConvFact}_{\text{CTD}}$
Effective duration:	$= \frac{(PV_-) - (PV_+)}{2(\Delta\text{Curve})(PV_0)} = \sum_{k=1}^{n} \text{KeyRateDur}_k$
Effective convexity	$= \frac{(PV_-) + (PV_+) - 2(PV_0)}{(\Delta\text{Curve})^2(PV_0)}$
Rolling yield	= Coupon income + Rolldown return
Rolldown return:	$= \frac{(\text{Bond price}_{\text{End-of-horizon period}} - \text{Bond price}_{\text{Beginning-of-horizon period}})}{\text{Bond price}_{\text{Beginning-of-horizon period}}}$
Δ price views yield	= (–ModDur × ΔYield) + [½ × Convexity × $(\Delta\text{Yield})^2$]
Δ price views spread	= (–ModSpreadDur × ΔSpread) + [½ × Convexity × $(\Delta\text{Spread})^2$]
Leveraged return:	$r_P = \frac{r_I \times (V_E + V_B) - (V_B \times r_B)}{V_E}$
Butterfly spread	2 × $\text{Yield}_{\text{Medium}}$ – $\text{Yield}_{\text{Short}}$ – $\text{Yield}_{\text{Long}}$ ~ positive view: decrease in spread
Quantifying credit spread changes:	Close to par: one period spread = LGD × POD ~ spread combination of credit + liquidity risk Distressed = 1 – LGD i.e. recovery rate
Excess Spread	= (Spread_0/periods) – (EffSpreadDur × ΔSpread) ~ – POD × LDG for E[Excess Spread Return]
CDS protection cost *% of notional amount*	= (CDS Spread – Protect Pmt) * EffSpreadDur ~ exchanged upfront, MTM using new spread

Select effect:	$W_B\,(R_P - R_B)$	Interact effect	$(W_P - W_B)\,(R_P - R_B)$
BHB alloc:	$(W_P - W_B)\,R_B$ *does not penalize cost of not being in mkt*		
BF alloc:	$(W_P - W_B)\,(R_B - R_{Bmk\ Total})$ *same total effect as above*		
Type I error: false pos – incorrectly pass test hired manager underperforms			

Yield spread:	Nearest gov bond: slope bias, mat. mismatch
G-Spread:	Bond YTM and linear interpolation treasury
I-Spread:	Short term swaps across all maturities MRR
ASW	Bond's coupon – interpolated swap rate
Z-Spread	Derived constant spread over gov spot curve
CDS-Spread	Issuer CDS – Z-Spread = pos/neg basis
OAS-Spread	Derived as Z-spread using arb-free rate options
Spread factor:	%Δ spread * DTS = %Δ spread

Eff Spread Tran Cost:	= Trade size × Trade price – $\left(\frac{\text{Bid}+\text{Ask}}{2}\right)$
Eff Spread	= 2 × $\left(\frac{\text{Bid}+\text{Ask}}{2}\right)$ – Trade price
Implementation Shortfall	= Paper return – Actual return *(includes fees)* = Execution Cost + Opportunity Cost +Fee
Execution cost	$= \sum s_j p_j - \sum s_j p_d$ *: executed – executed @ dec* $\underbrace{\left(\sum s_j\right)p_0 - \left(\sum s_j\right)p_d}_{\text{Delay cost}} + \underbrace{\sum s_j p_j - \left(\sum s_j\right)p_0}_{\text{Trading cost}}$
Opportunity cost	$= \left(S - \sum s_j\right)(P_n - P_d)$ *: unexecuted * (now – dec)*
Trade costs:	$\frac{(\bar{P} - P^*)}{P^*} \times 10{,}000$ bps where P^* = arrival, VWAP...
Index cost	$= \frac{(\text{Index VWAP} - \text{Index arrival price})}{\text{Index arrival price}} \times 10^4$
Market-adjusted cost	= Arrival cost (bps) – β × Index cost (bps)

Sortino ratio: *~ above a target* *~ capital preservation*	$\widehat{\text{SR}}_D = \frac{\bar{r}_p - \bar{r}_T}{\hat{\sigma}_D}$
Treynor ratio: *~ systematic risk*	$T_A = \frac{\bar{R}_A - \bar{r}_f}{\hat{\beta}_A}$
Upside capture	Geometric R_{Port}/R_{Bmk} when $R_{Bmk} > 0$
Carhart *(factor based)*	$R_p - R_f = a_p + b_{p1}\text{RMRF} + b_{p2}\text{SMB} + b_{p3}\text{HML} + b_{p4}\text{WML} + E_p$ *pos sensitivities indicate small value momentum* *SS = Active rtn - ∑net port sensitivity*factor rtn*

Call-put parity	$S_0 + p_0 = c_0 + X/(1+r)^T$ $F_0(T)/(1+r)^T + p_0 = c_0 + X/(1+r)^T$
Protective puts/calls *limit downside* at the *expense* of option premium. Covered puts/calls *limit upside* for *receipt* of option premium.	
Bull/bear spreads: long & short the same instrument, different strike prices > initial net outflow always negative, calls with lower X expensive > Put bear spread breakeven such that $-S_T + X_H - P_H + P_L = 0$	
A collar is a protective put financed by writing a call at a higher strike price > assumes stock already held, all payoffs positive if appreciated	
Long calendar spread: buy distant-dated call option, short near-dated call > capture time value if price change is not imminent, after early expiry > also if IV is to increase	
Volatility Skew: IV increases for OTM puts & decreases for OTM calls > Risk reversal buy relatively undervalued OTM call & sell put	
Contango: volatility higher on long-term options decreases to spot at expiry > negative roll-down losses on futures, buy puts/write calls > Swap payoff = Notional × (Realized Variance − Implied Variance)	
Min var. hedge ratio:	$h = \rho\left(\frac{\rho R_D; R}{F_{FX}}\right) \times \left[\frac{\sigma(R_{DC})}{\sigma(R_{FX})}\right]$ — *h% short foreign long forward /R_D*
Cash equitization:	$N_f \beta_f F_{Contract\ Size}$ = *Desired exposure* × β_{Target}
Target portfolio duration = $\text{ModD}_{\text{Target}}$ * MV_{Port} = ∑ ModD_i * MV_i	
Variance Notional:	$= \frac{\text{Vega notional}}{2 \times \text{Strike price}}$
$\text{Var Swap}_t = \text{notional} \times PV_t(T) \times \left\{\frac{t}{T} \times \left[\text{RealizedVol}(0,t)\right]^2 + \frac{T-t}{T} \times \left[\text{ImpliedVol}(t,T)\right]^2 - \text{Strike}^2\right\}$	
Prob rate change:	$\frac{\text{Effective federal funds rate implied by futures contract} - \text{Current federal funds rate}}{\text{Federal funds rate assuming a rate hike} - \text{Current federal funds rate}}$
Immunized convexity:	$\frac{\text{MacDur}^2 + \text{MacDur} + \text{Dispersion}}{(1 + \text{Cash flow yield})^2}$