



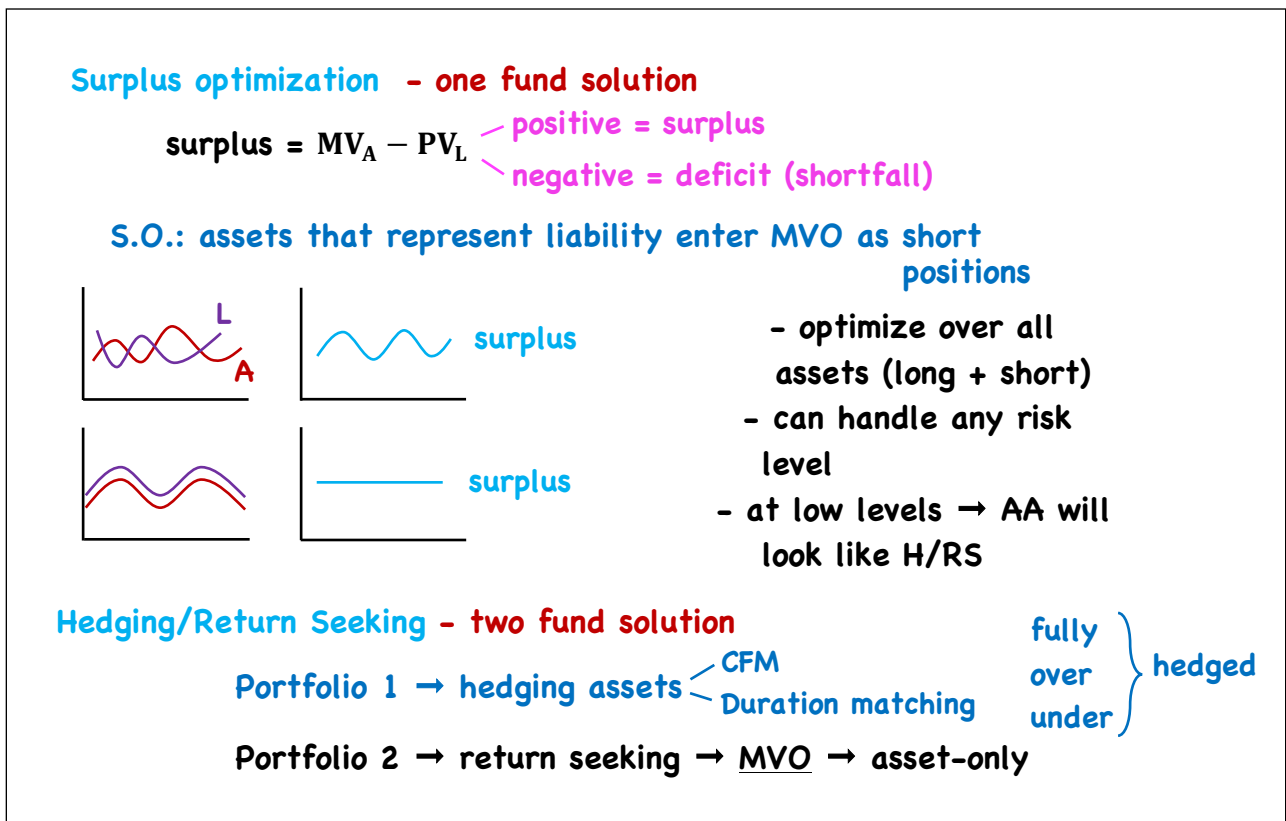
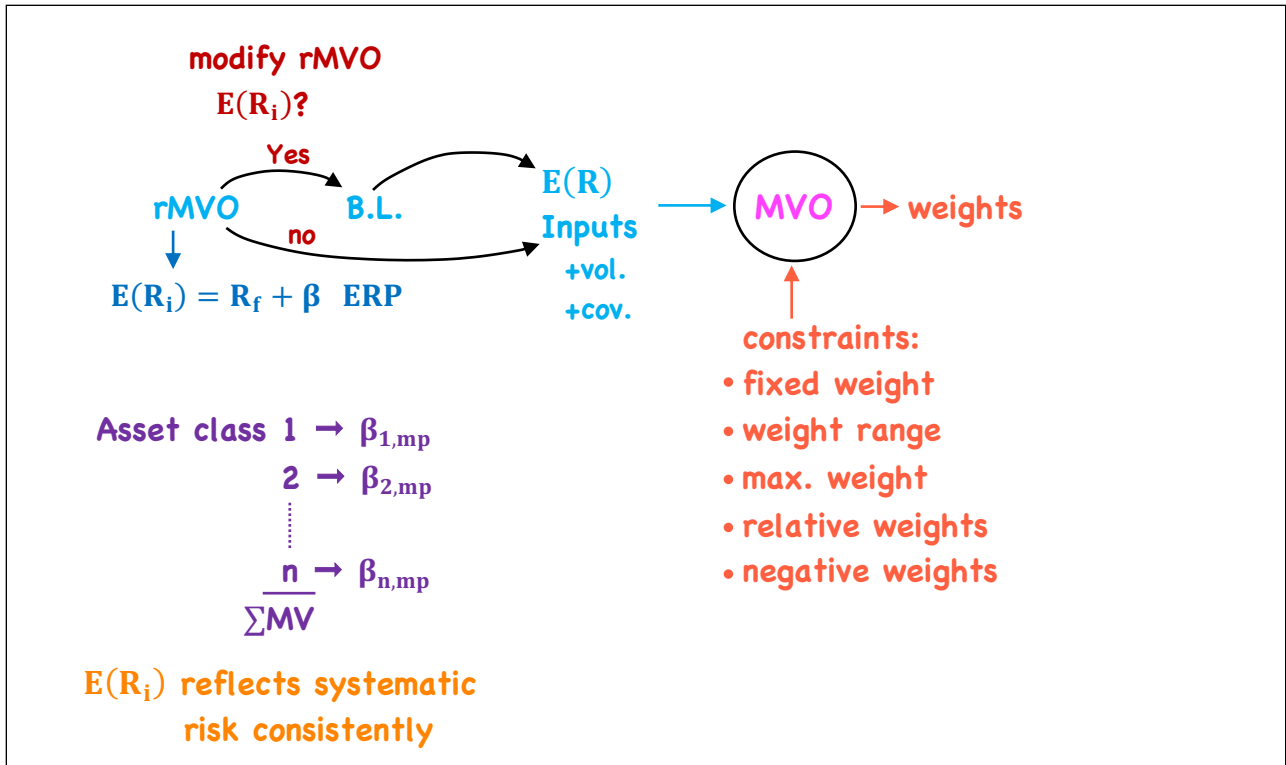
2026 Level 3 - Seminars

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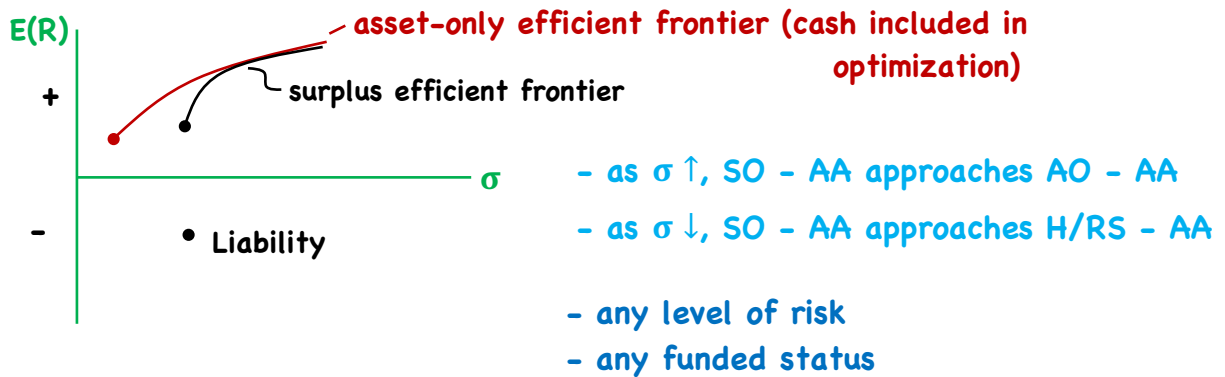
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Asset Allocation



Surplus optimization



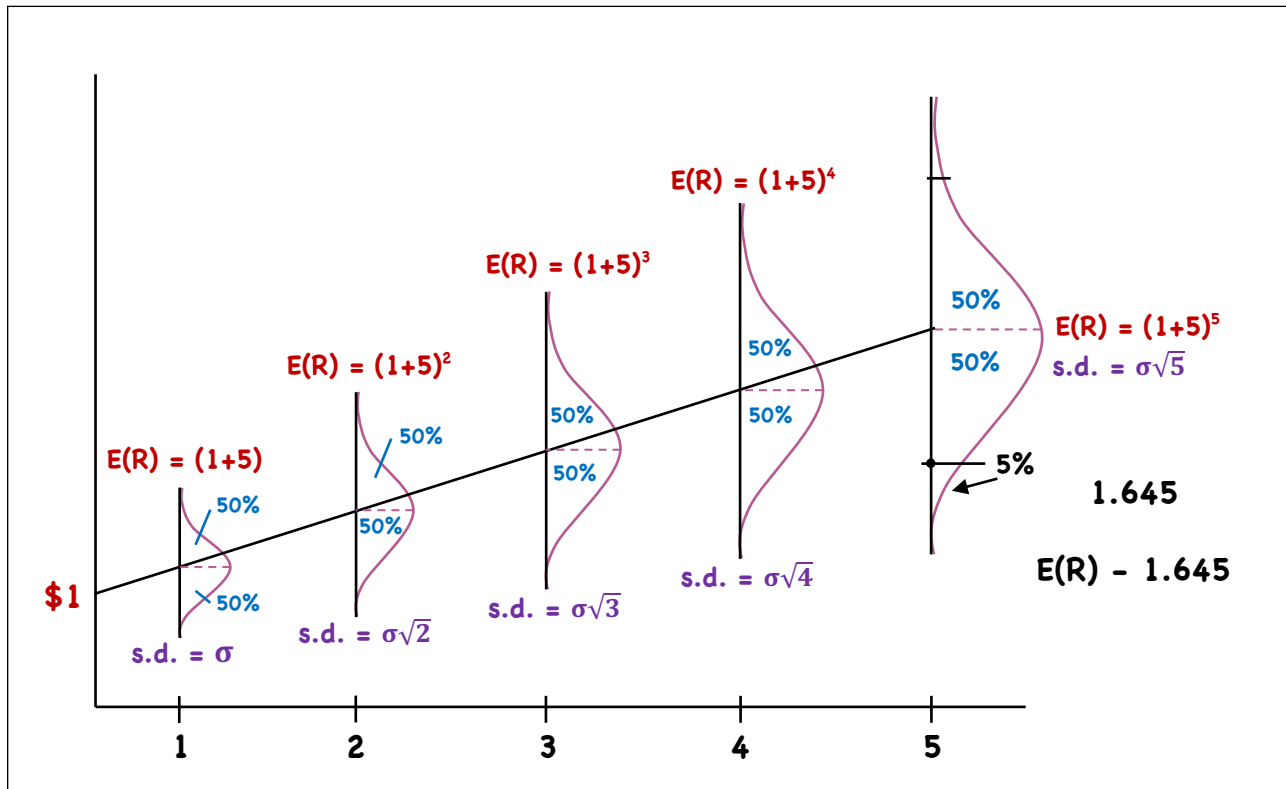
Hedging/Return Seeking - low levels of risk only
- as hedge ratio $\rightarrow 0\%$, HP $\rightarrow \$0$, RS \rightarrow AO

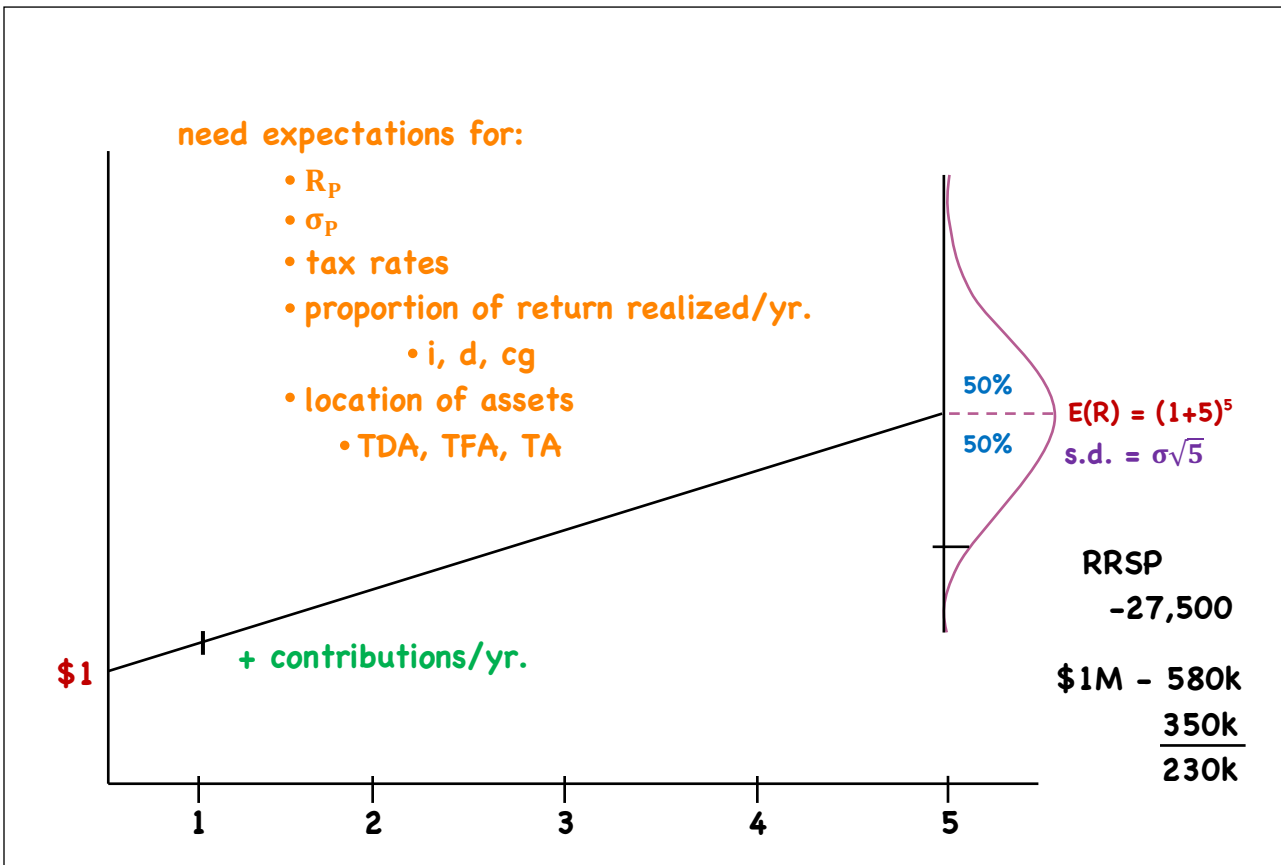
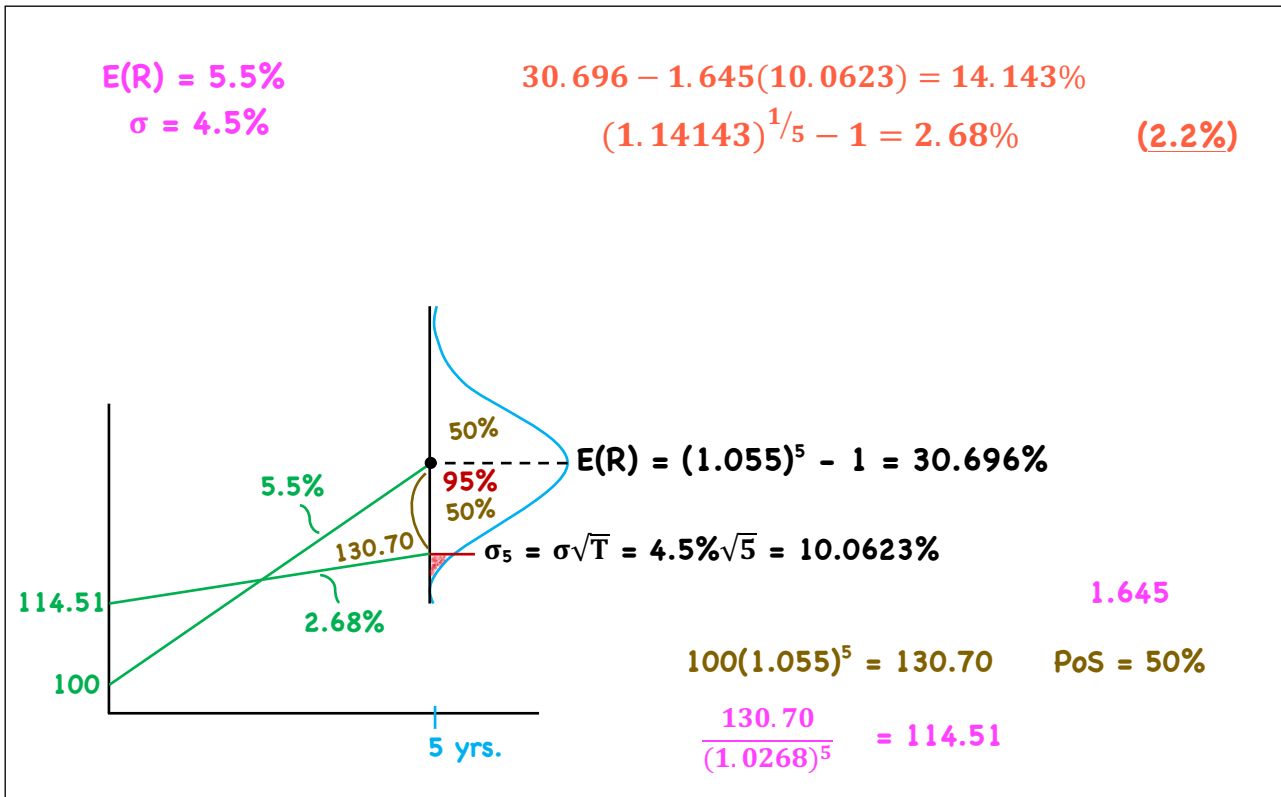
- underfunded \rightarrow hedge 100% if contributions expected
 \rightarrow $< 100\%$ else, use liability glide path

Capital Sufficiency Analysis

Exhibit 36 "Highest Probability- and Horizon-Adjusted Return" Sub-Portfolio Module under Different Horizon and Probability Scenarios

| | A | B | C | D | E | F |
|---|------|------|------|-------|-------|-------|
| Portfolio Characteristics | | | | | | |
| Expected return | 4.3% | 5.5% | 6.4% | 7.2% | 8.0% | 8.7% |
| Expected volatility | 2.7% | 4.5% | 6.0% | 7.5% | 10.0% | 12.5% |
| Annualized Minimum Expectation Returns | | | | | | |
| Time Horizon (years) | 5 | | | | | |
| Required Success | | | | | | |
| 99% | 1.5% | 0.9% | 0.2% | -0.6% | -2.4% | -4.3% |
| 95 | 2.3 | 2.2 | 2.0 | 1.7 | 0.7 | -0.5 |
| 90 | 2.7 | 3.0 | 3.0 | 2.9 | 2.3 | 1.5 |
| 75 | 3.5 | 4.2 | 4.6 | 4.9 | 5.0 | 4.9 |
| Time Horizon (years) | 10 | | | | | |
| Required Success | | | | | | |
| 99% | 2.3% | 2.2% | 2.0% | 1.7% | 0.7% | -0.5% |
| 90 | 3.2 | 3.7 | 4.0 | 4.1 | 4.0 | 3.6 |
| 75 | 3.7 | 4.6 | 5.1 | 5.6 | 5.9 | 6.0% |
| 60 | 4.1 | 5.2 | 5.9 | 6.6 | 7.2 | 7.7 |
| Time Horizon (years) | 20 | | | | | |



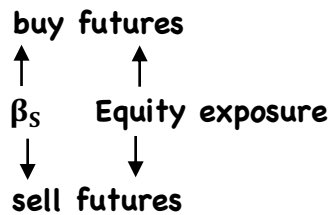


Derivative Strategies

• Changing β

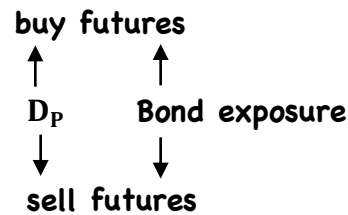
Equity Index ← futures → Treasury Bond Futures

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



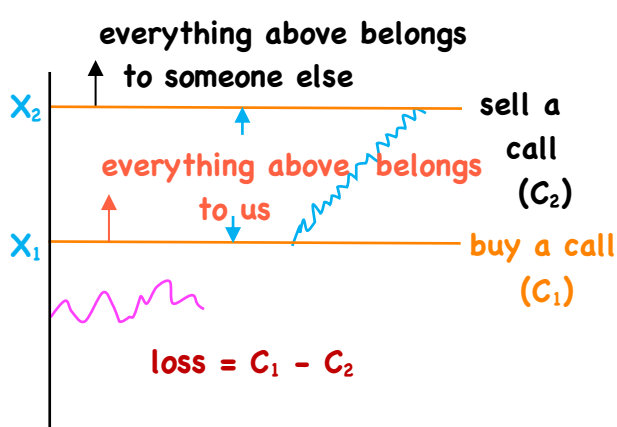
• Changing Duration

$$N_f = \frac{DD_T - DD_P}{DD_F}$$



- lower transaction costs
- equitize cash
- de-equitize

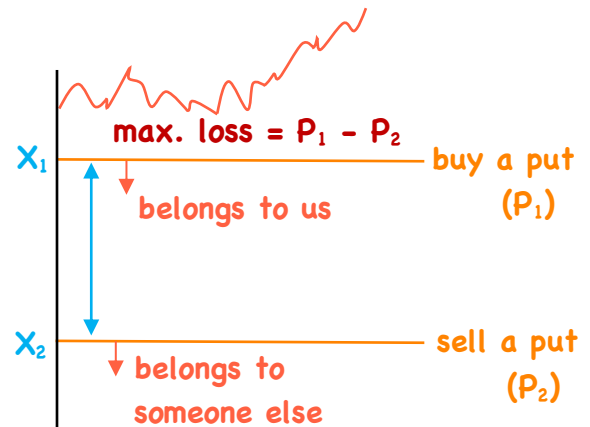
Options



$$\text{max. gain} = X_2 - X_1$$

$$\text{max. profit} = (X_2 - X_1) - (C_1 - C_2)$$

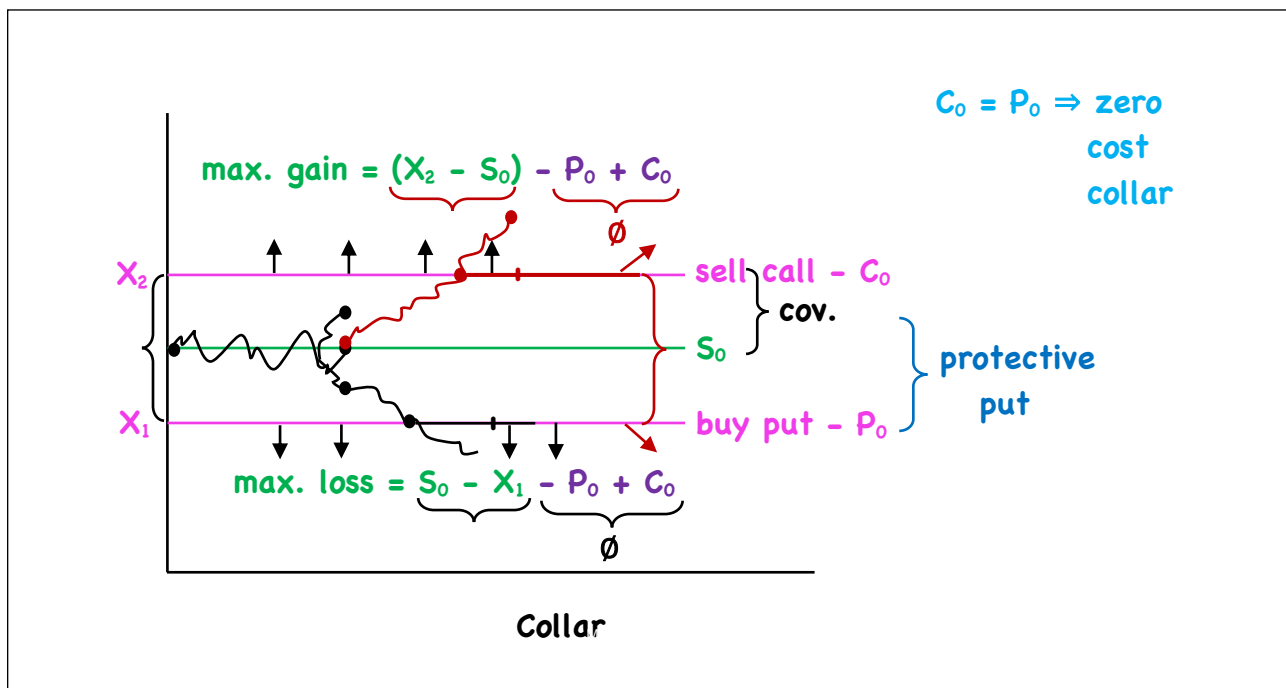
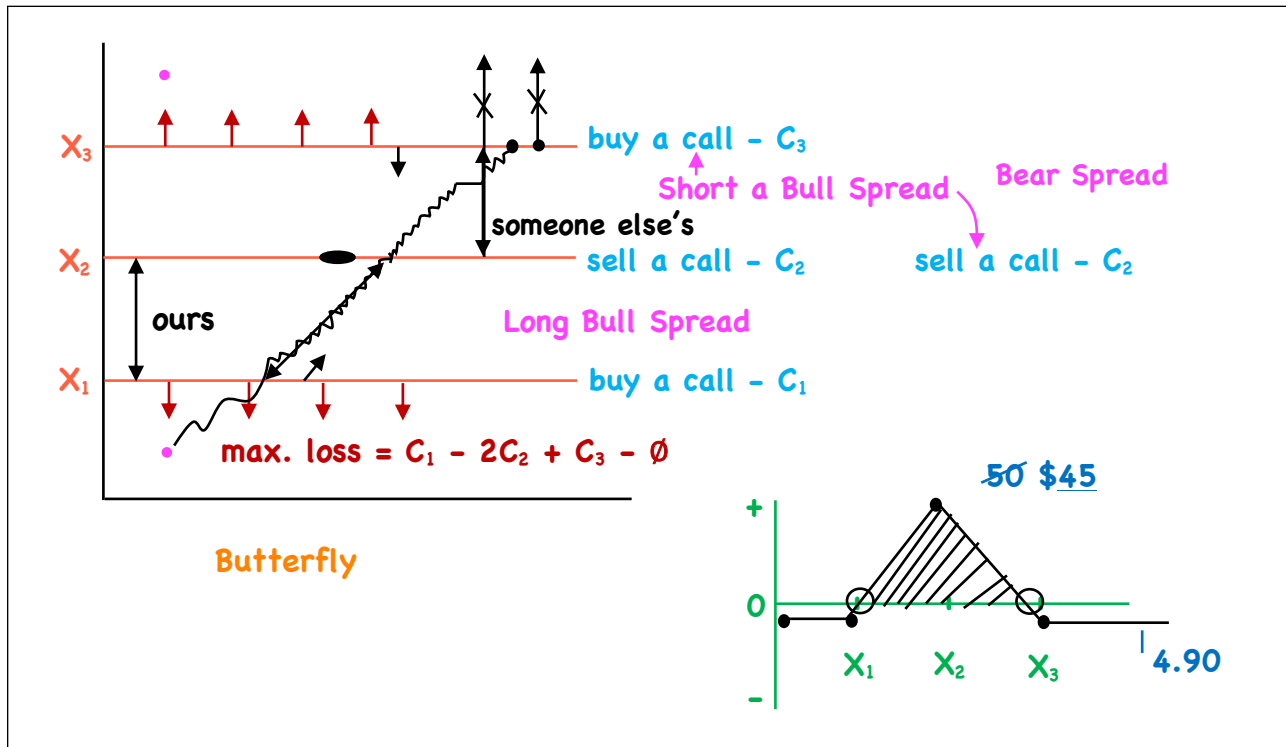
$$X_2 - X_1 - C_1 + C_2$$



$$\text{max. gain} = X_1 - X_2$$

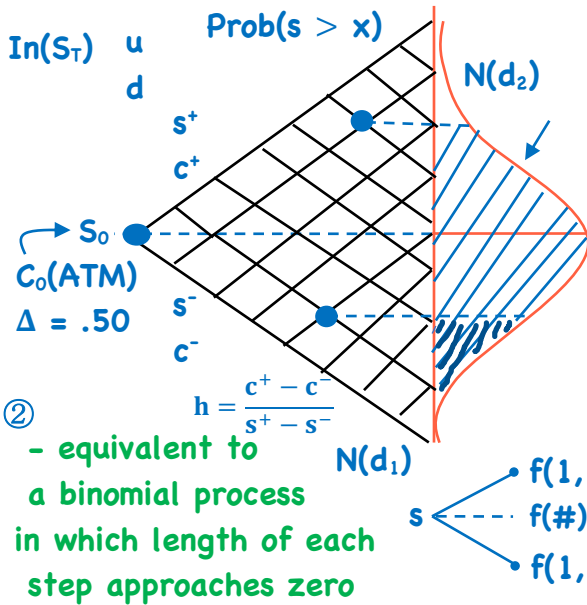
$$\text{max. profit} = X_1 - X_2 - (P_1 - P_2)$$

$$X_1 - X_2 - P_1 + P_2$$



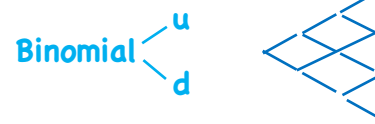
Black-Scholes-Merton (BSM) Model

BSM - no arbitrage approach but in continuous time



① - with a large # of steps, binomial process converges to a normal distribution

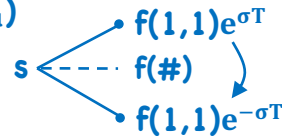
discrete - continuous



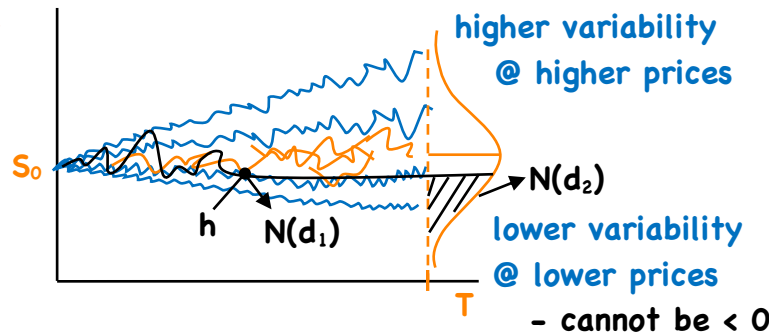
BSM - Geometric Brownian motion

e.g. ABC $E(R) = 3\%$
 $\sigma = 45\%$

② - equivalent to a binomial process in which length of each step approaches zero



- log-normal



Assumptions/ r_f • is contin. compounded
 - known & constant

σ • is known & constant

yield of underlying • contin. compounded, known & constant yield, annualized

contin. compounding since BSM is a continuous time version of the discrete time binomial model

hedger.
 $c = SN(d_1) - e^{rT} \times N(d_2)$ $\text{Prob}(s_T > x)$

$d_1 = \frac{\ln(S/X) + (r + \sigma^2/2)T}{\sigma\sqrt{T}}$
 $d_2 = d_1 - \sigma\sqrt{T}$

$p = e^{-rT} \times N(-d_2) - SN(-d_1)$

$s = 70$ ($c = s_T - x$)
 $x = 50$ ($p = x - s_T$)

Z-values
 $N(d_1)$ $N(d_2)$
 hedge $s > x$
 r^-

standard normal CUMULATIVE distribution function

called a normal probability density function

$h = \frac{c^+ - c^-}{s^+ - s^-} \sim n(d_1)$

$y = 2x \quad \forall x, y > 0$
 $y = \text{non linear}$

$c = SN(d_1) - e^{rT} \times N(d_2)$

$p = e^{-rT} \times N(-d_2) - SN(-d_1)$

$d_1 = \frac{\ln(S/X) + (r + \sigma^2/2)T}{\sigma\sqrt{T}}$
 $d_2 = d_1 - \sigma\sqrt{T}$

| $S_0 = 50$ | $x = 50$ | $\sigma = 30\%$ | $r = 2\%$ | 1-YR. call | Call |
|------------|----------|-----------------|-----------|------------|------------------|
| S | $N(d_1)$ | $N(d_2)$ | C | P | |
| 25 | .01814 | .00834 | .04486 | 24.05479 | .4535 |
| 30 | .06863 | .03704 | .24339 | 19.25332 | .40874 |
| 35 | .16546 | .10164 | .80973 | 14.81967 | .04476 |
| 40 | .29905 | .20408 | 1.96004 | 10.96997 | $N(d_1)$ |
| 45 | .44649 | .33195 | 3.82319 | 7.83313 | buy .01814 |
| 50 | .58577 | .46679 | 6.41079 | 5.42072 | shares @ \$25 |
| 55 | .70346 | .59265 | 9.64435 | 3.65429 | - finance with |
| 60 | .79515 | .70000 | 13.40169 | 2.41162 | borrowing of |
| 65 | .86241 | .78559 | 17.55496 | 1.56489 | .40874 $N(d_2)$ |
| 70 | .90959 | .85042 | 21.99229 | 1.00223 | • borrowing less |
| 75 | .94158 | .89764 | 26.62559 | 0.63552 | than underlying |

$$c = SN(d_1) - e^{rT} \times N(d_2)$$

$$d_1 = \frac{\ln(S/X) + (r + \sigma^2/2) T}{\sigma\sqrt{T}}$$

$$p = e^{-rT} \times N(-d_2) - SN(-d_1)$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

| $S_0 = 50$ | $x = 50$ | $\sigma = 30\%$ | $r = 2\%$ | 1-YR. call | Put |
|------------|----------------|-----------------|-----------|--------------|------------------------------|
| S | $N(d_1)$ | $N(d_2)$ | C | P | |
| $s = 25$ | $(1 - .01814)$ | $(1 - .00834)$ | .04486 | (24.05479) | Sell \$24.5465 |
| 30 | .06863 | .03704 | .24339 | 19.25332 | Invest <u>48.6011</u> |
| 35 | .16546 | .10164 | .80973 | 14.81967 | <u>24.0546</u> |
| 40 | .29905 | .20408 | 1.96004 | 10.96997 | Sell $(1 - .01814)$ |
| 45 | .44649 | .33195 | 3.82319 | 7.83313 | shares @ \$25 |
| $x = 50$ | .58577 | .46679 | 6.41079 | 5.42072 | - finance with |
| 55 | .70346 | .59265 | 9.64435 | 3.65429 | lending of |
| 60 | .79515 | .70000 | 13.40169 | 2.41162 | $(1 - .00834) \times e^{rT}$ |
| 65 | .86241 | .78559 | 17.55496 | 1.56489 | • investing more |
| 70 | .90959 | .85042 | 21.99229 | 1.00223 | than underlying |
| 75 | .94158 | .89764 | 26.62559 | 0.63552 | |