FINC2012: Finals Notes

Lecture 1/Week 1: Risk and Return

1.2 The problem

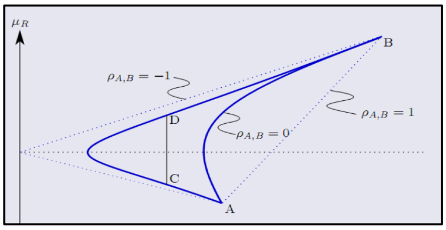
- Companies and individuals buy & sell securities
  - $Price =$ $PV\ (Expected\ future\ cashflow) = \frac{E[future\ cash\ flow]}{discount\ factor}$
- Different models make different assumptions
  - Future cashflows (magnitude and timing)
  - Probability associated with each future cashflow
  - Present value calculation (discount rate)
- Returns
  - $r_1 = \frac{P_1 - P_0}{P_0}$
  - $E(r) = E\left(\frac{P_1 - P_0}{P_0}\right)$

1.3 Measuring returns – arithmetic & geometric average

- Company is worth $100 on Monday. On Wednesday you decide
  - Possible value probability is 1/3 for all: $90, 110, 130
- Arithmetic average – expected value
  - Historical return: add & divide by n
  - Future returns: multiply by probability then add (thus 1/n is proxy for probability of return)
  - Use for estimating <u>cost of capital from historical returns</u> OR estimating <u>OC of capital p.a</u>.
  - $E(r) = \frac{1}{3}(-10) + \frac{1}{3}(10) + \frac{1}{3}(30) = 10\%$
- Geometric – average return actually earned over 3yr investment
  - $\left(\left(-\frac{0.1}{3}\right)\left(\frac{0.1}{3}\right)\left(\frac{0.3}{3}\right)\right)^{\frac{1}{3}} = (-111.11\%^3)^{1/3}$
  - Negative term so not interpretable
  - Multiply then raise to power of 1/n
  - Use for estimating <u>compounding changes in wealth</u>
- Compound – geometric mean/average
  - $((0.9)(1.10)(1.30))^{\frac{1}{3}} = (1.287)^{1/3} = 108.77\%$, investment increased 8.77%

1.4 Measuring risk – variance (SD)

- Variance: $\sigma^2 = E\left[(x - E(X))^2\right]$
  - Flipping a coin getting $10 for heads, $-10 for tails then $\sigma^2 = 0.5(10-0)^2 + 0.5(-10-0)^2 = \$100^2$
- Thus use SD instead $\sigma = 10\%$
- Risk and return measure in comparable units



1.5 Variance and Covariance

- Covariance: measure of co-movement, $covar(x, y)\ or\ \sigma_{x,y}$
  - $E[(x - E(X))(y - E(Y))]$
  - Negative: x achieves below average returns at same time when y achieve above average
  - Positive: x achieves above average returns at same time as y
  - Positive: x achieves below average returns at same time as y
- $\sigma_{1,2} = \rho_{1,2}\sigma_1\sigma_2$
  - $\rho_{1,2}$ is correlation between 1 and 2, bound between 1 and -1, σ_1 is SD of 1, σ_2 is SD of 2 Can compare correlation 1&2 and 3&4 – degree to which they move in same direction
  - Cannot compare from $\sigma_{1,2}$

	Exxon - Mobil	Coca - Cola
Exxon - Mobil	$x_1^2\sigma_1^2 = (.60)^2 \times (18.2)^2$	$x_1 x_2 \rho_{12}\sigma_1\sigma_2 = .40 \times .60 \times 1 \times 18.2 \times 27.3$
Coca - Cola	$x_1 x_2 \rho_{12}\sigma_1\sigma_2 = .40 \times .60 \times 1 \times 18.2 \times 27.3$	$x_2^2\sigma_2^2 = (.40)^2 \times (27.3)^2$

1.6 Securities affect on portfolios

- Portfolio variance σ_p^2, calculated two ways
  - Take portfolio of one security then calculate average return and variance following previous method
  - Calculate weighted sum of individual security variances and covariance, $\sigma_p^2 = \sum_i^N \sum_j^N \omega_i \omega_j \sigma_{i,j}$, with N number of securities, weights, covariance