Drivers in the Case of Two Assets

Future Returns Are Random In Nature

Optimizing Portfolio requires expectations:

- about average portfolio return (mean)
- about how far off it may be (variance)

Why?

Portfolio Return Is A Random Variable

Past Performance to Predictions

	Mean Portfolio Return
Computed on a sample of T Historical Returns	$\hat{\mu} = \frac{R_1 + R_2 + \cdots + R_T}{T}$
When the return is a random variable	$\mu = E[R]$

	Portfolio Return Variance
Computed on a sample of T Historical Returns	$\hat{\sigma}^2 = \frac{(R_1 - \hat{\mu})^2 + (R_2 - \hat{\mu})^2 + \cdots + (R_T - \hat{\mu})^2}{T - 1}$
When the return is a random variable	$\sigma^2 = \mathbf{E}[\ (R - \mu)^2\ ]$

Drivers of Mean & Variance

- Assume two assets:

Asset 1	Asset 2
Weight: w_1	Weight: w_2
Return: R_1	Return: R_2

- **Portfolio Return:** $w_1 * R_1 + w_2 * R_2$
- Thus: $\boxed{E[\text{Portfolio return}] = w_1 * E[R_1] + w_2 * E[R_2]}$

Portfolio Return Variance

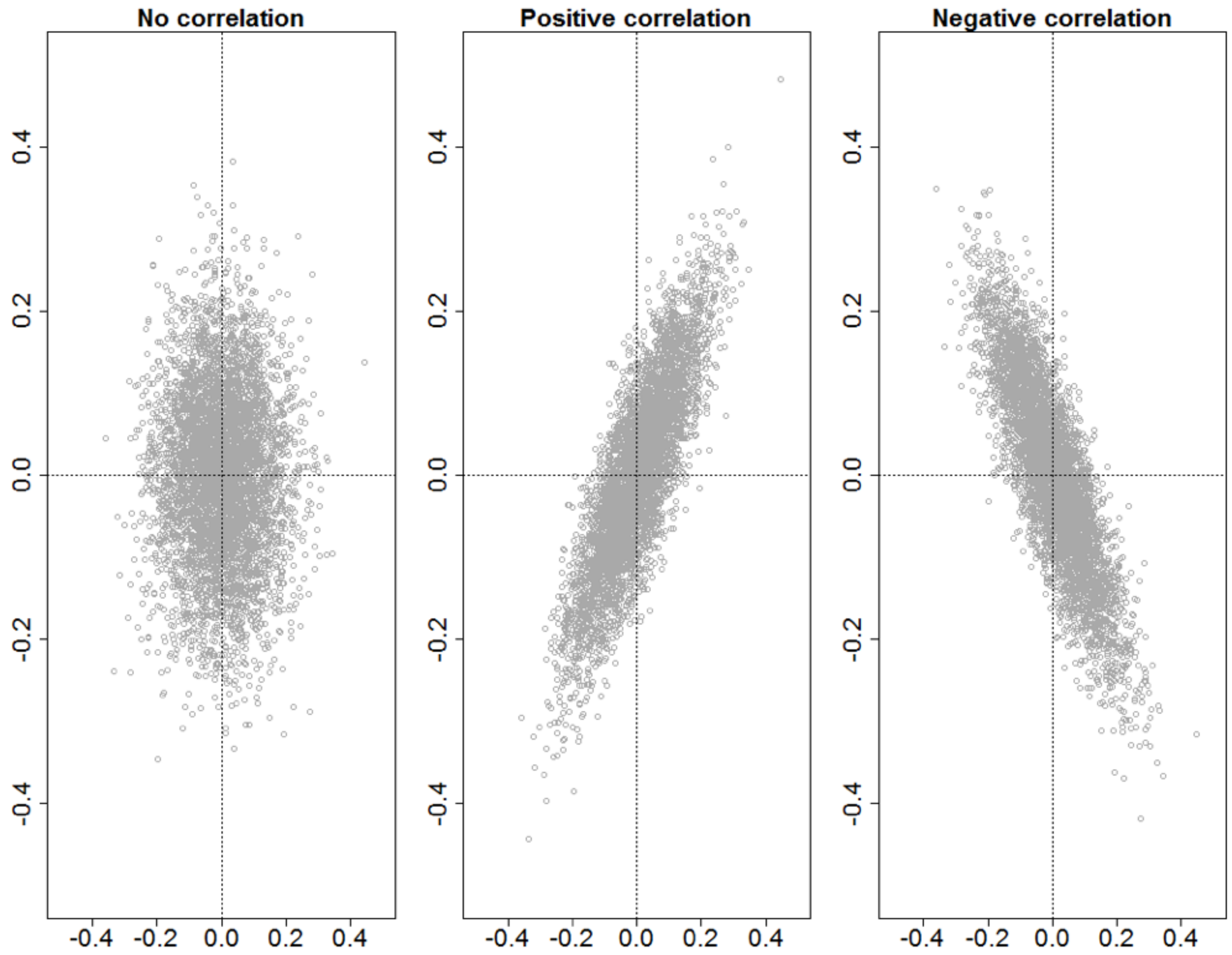
Variance of Portfolio Return =

$$w_1^2 * var(R_1) + w_2^2 * var(R_2) + 2 * w_1 * w_2 * cov(R_1, R_2)$$

Covariance between return 1 and 2 =

$$Cov(R_1, R_2) = StdDev(R_1) * StdDev(R_2) * corr(R_1, R_2)$$

Correlations



Take Away Formulas

- E[Portfolio Return] = $w_1 * E[R_1] + w_2 * E[R_2]$

- var(portfolio return) $= w_1^2 * var(R_1) + w_2^2 * var(R_2) + 2 * w_1 * w_2 * cov(R_1, R_2)$