PORTFOLIO OF 2 ASSETS:

A μ_A $\underset{\sigma^2(A)}{\text{VAR}(A)}$ $\underset{\sigma(A)}{\text{STDEV}(A)}$ $\text{cov}(A,B)$

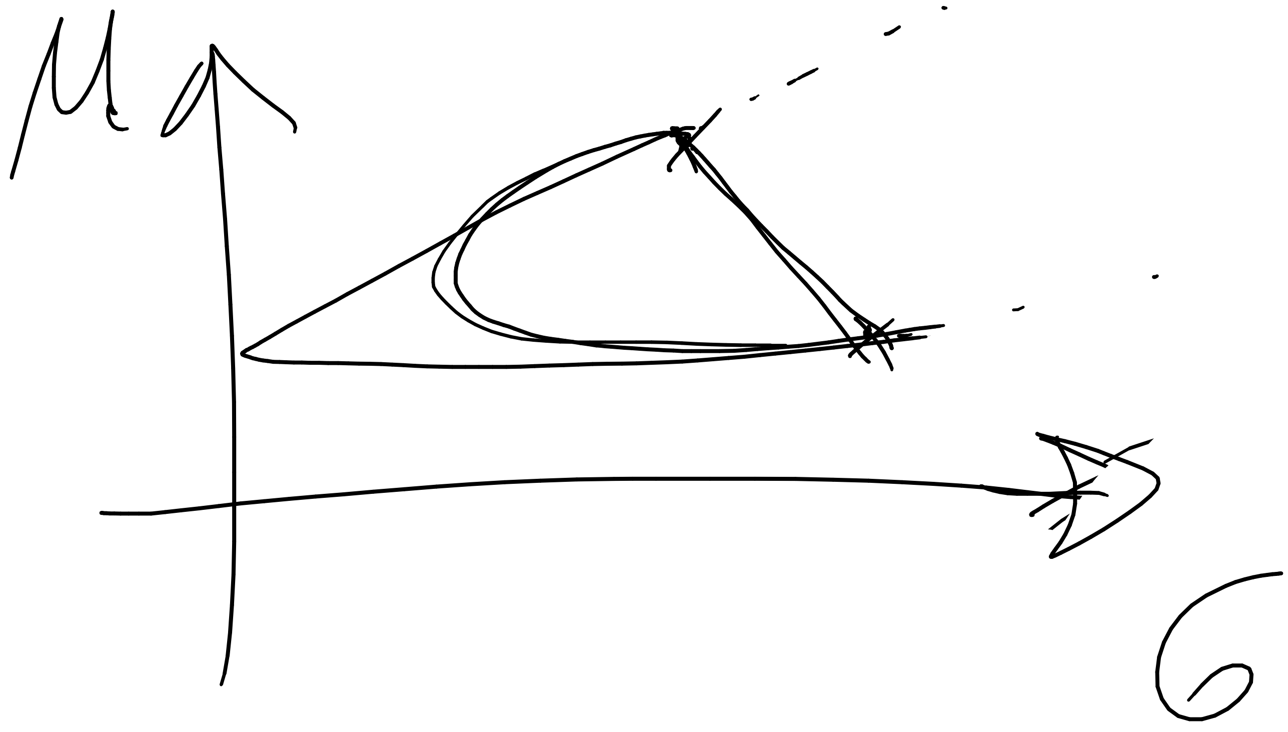
B μ_B VAR(B) STDEV(B)

$$\rho(A,B) = \frac{\text{cov}(A,B)}{\sigma_A \sigma_B}$$

α in A and $(1-\alpha)$ in B

$$\mu_p = \alpha \cdot \mu_A + (1-\alpha) \cdot \mu_B$$

$$\sigma_p^2 = \alpha^2 \cdot \sigma_A^2 + (1-\alpha)^2 \sigma_B^2 + 2\alpha \cdot (1-\alpha) \cdot \overbrace{\text{cov}(A,B)}^{\rho_{AB} \cdot \sigma_A \cdot \sigma_B}$$


μ
σ

4 ASSETS n ASSET

A	B	C	D
0,1	0,3	0,4	0,2

$$E(R) = \mu$$

$$\begin{bmatrix} \mu_A \\ \mu_B \\ \mu_C \\ \mu_D \end{bmatrix}$$

$$\mu_p = \begin{bmatrix} \; & \; & \; & \; \end{bmatrix} \cdot \begin{bmatrix} \; \\ \; \\ \; \\ \; \end{bmatrix} = \begin{bmatrix} \; \end{bmatrix}$$

VAR-COV MATRIX

$$
\begin{array}{c|cccc}
 & A & B & C & D \\
\hline
A & VAR_A & cov(A,B) & & \\
B & cov(B,A) & VAR_B & & \\
C & & & VAR_C & cov(C,D) \\
D & & & & VAR_D
\end{array}
$$

$$
\sigma_p^2 = \begin{bmatrix} 0{,}1 & 0{,}3 & 0{,}4 & 0{,}2 \end{bmatrix} \cdot \underbrace{\begin{bmatrix} \; & \; & \; & \; \\ & & & \\ & & & \\ & & & \end{bmatrix}}_{\text{VARCOV}} \cdot \begin{bmatrix} 0{,}1 \\ 0{,}3 \\ 0{,}4 \\ 0{,}2 \end{bmatrix}
$$

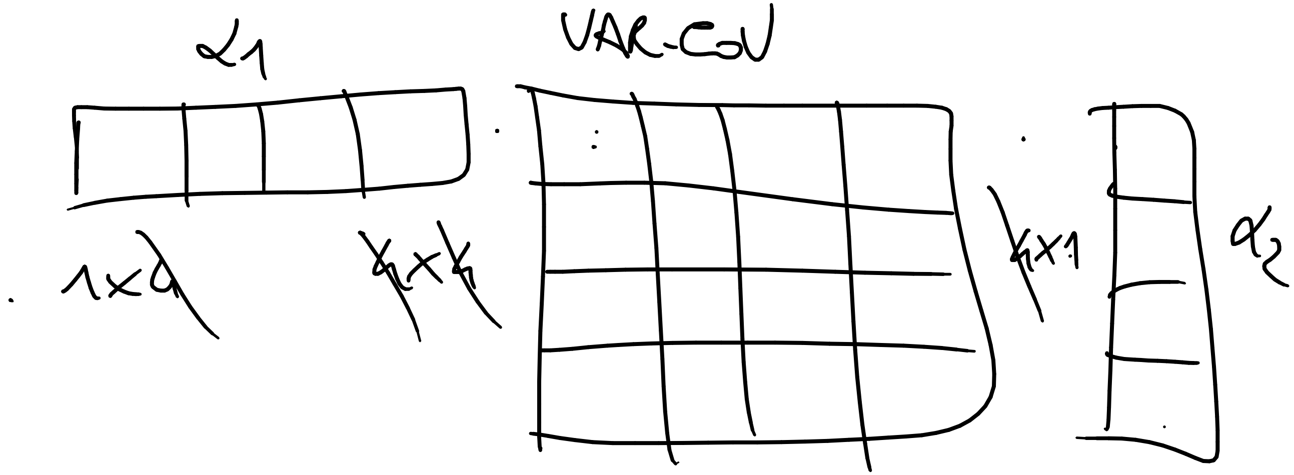
1 portfolio . $\begin{array}{c} \alpha_1 \\ \begin{bmatrix} 0{,}1 & 0{,}3 & 0{,}4 & 0{,}2 \end{bmatrix} \end{array}$

2 portfolio . $\begin{array}{c} \alpha_2 \\ \begin{bmatrix} 0{,}2 & 0{,}25 & 0{,}25 & 0{,}3 \end{bmatrix} \end{array}$

$$\mu_1 = \underset{\alpha_1}{[\quad\quad\quad]} \; \underset{R}{[\;]} \qquad \sigma_1^2 = \underset{\alpha_1}{[\;]} \; \underset{VARCOV}{[\;]} \; [\;]_{\alpha_1}$$

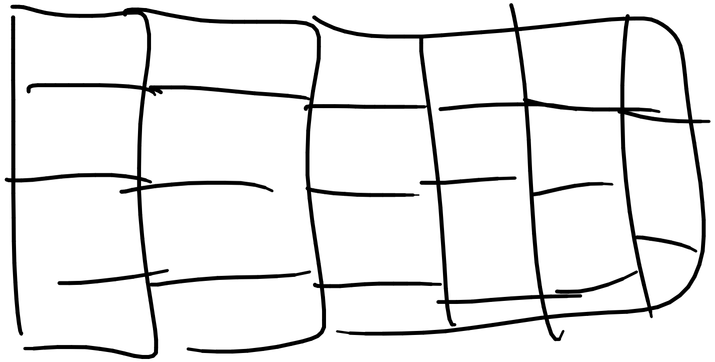
$$\mu_2 = \underset{\alpha_2}{[\quad\quad\quad]} \; \underset{R}{[\;]} \qquad \sigma_2^2 = \underset{\alpha_2}{[\;]} \; \underset{VARCOV}{[\;]} \; [\;]_{\alpha_2}$$

$COV(1,2) =$

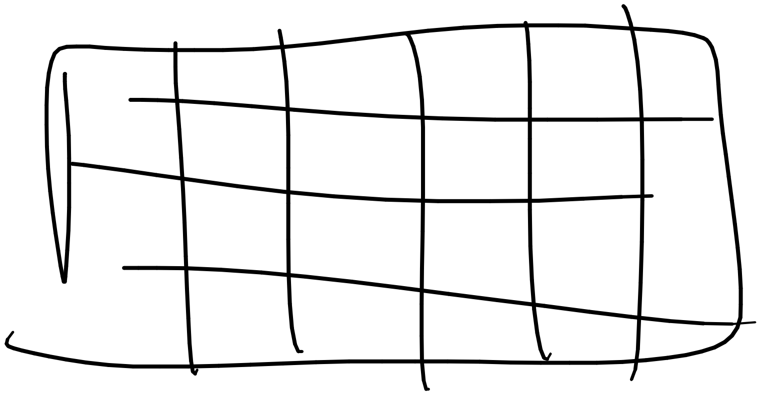


$MMULT(\alpha_1 ; MMULT(VAR\text{-}COV ; \alpha_2))$

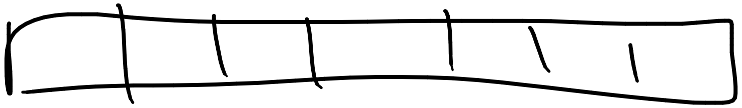
VARIANCE - COVARIANCE MATRIX



Prices $\rightarrow \ln\left(\frac{P_{t+1}}{P_t}\right)$



Returns



Average return

$$A = \begin{bmatrix} R_1^X - \mu^X & R_1^Y - \mu_Y & & \\ & & & \\ & & & R_{10}^Z - \mu_Z \end{bmatrix}$$

ADDITIONAL RETURNS MATRIX

$$\frac{A^T \cdot A}{N^\circ \text{ observations} = 10} = \text{VAR-COV MATRIX}$$