$R = +3\%\ f_a$ $\pm\ \delta$

Structural Products

(Blanket)

Makowitz

R

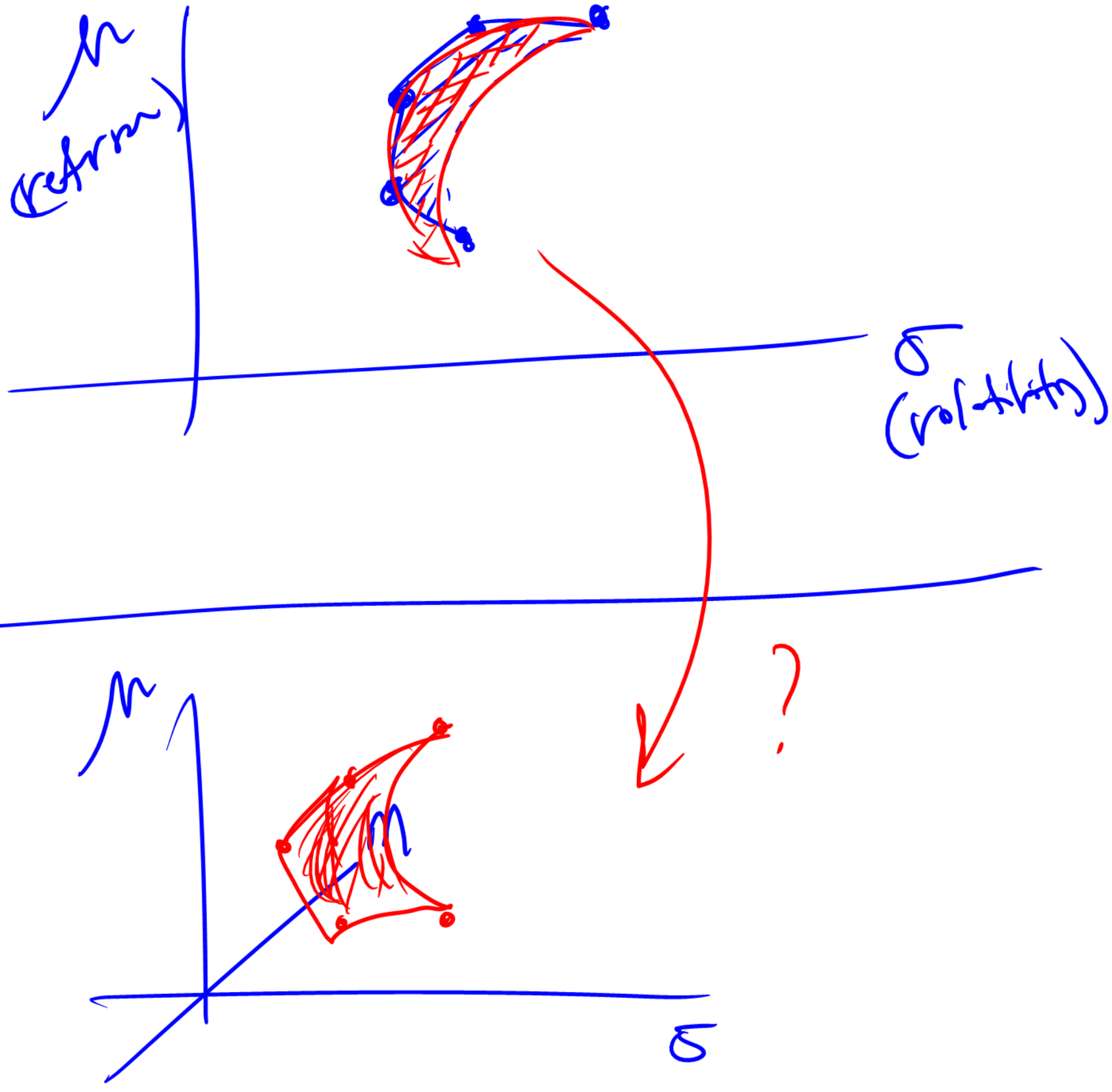
σ

M

+ shear + torsion

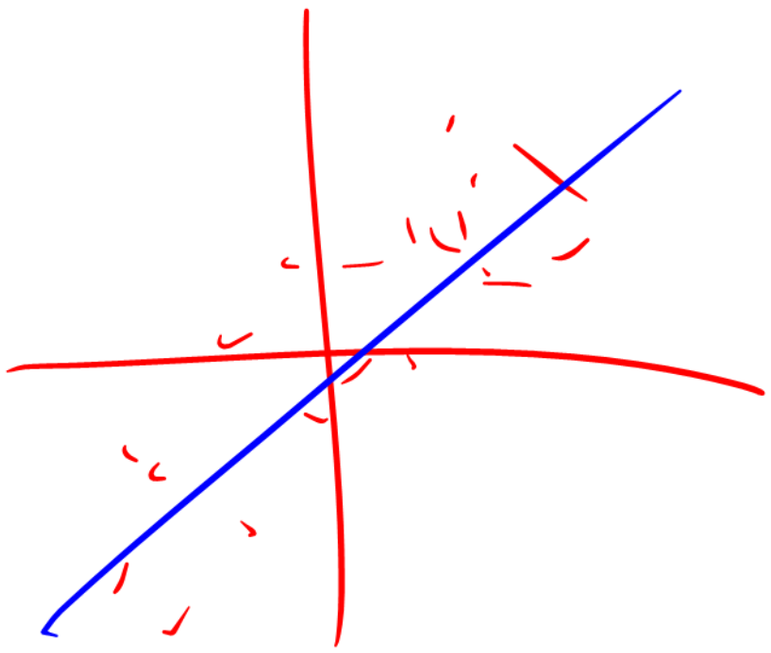
Markowitz (MPT)

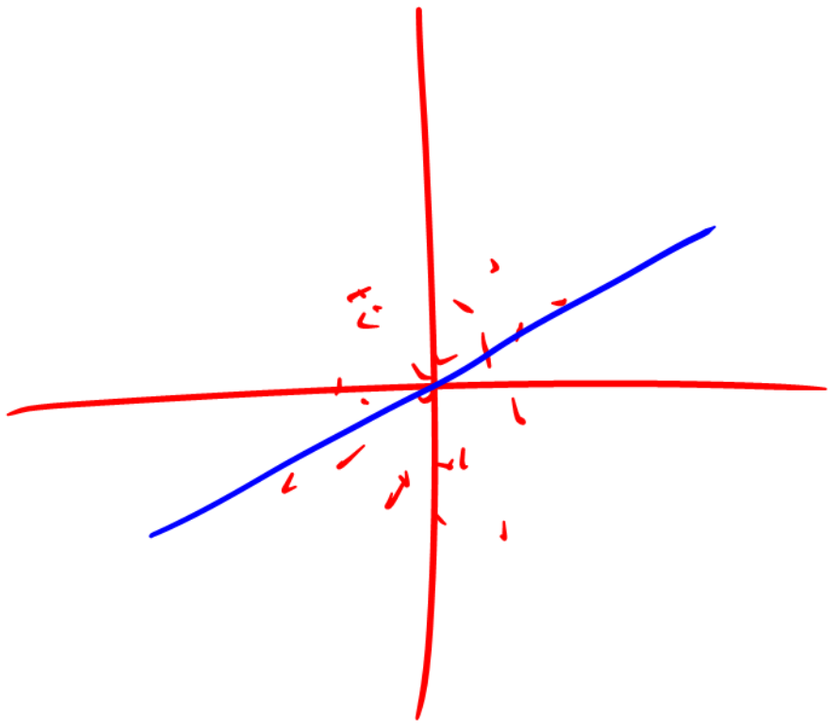
1950's



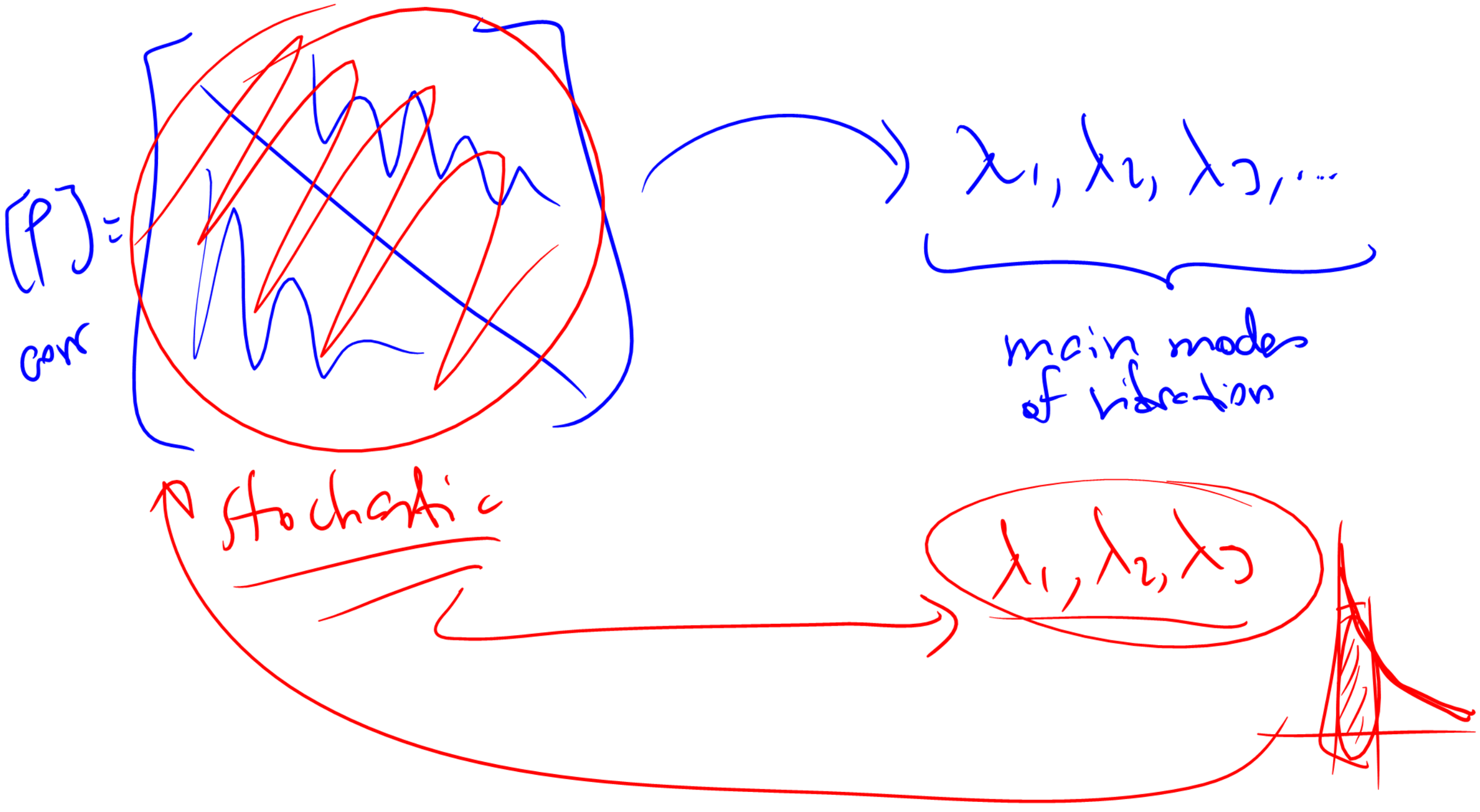
1990's

Black





Random Matrix Theory (RMT)



"impact"

losses

gains

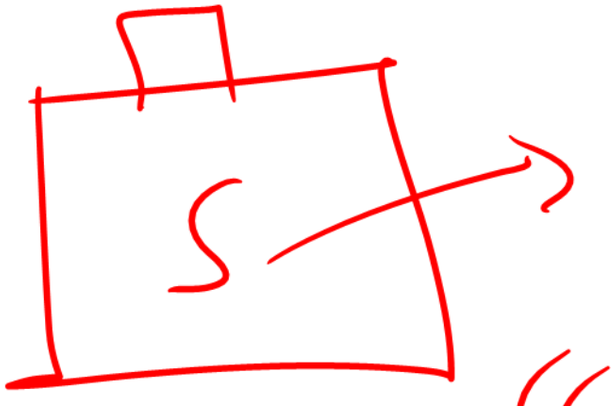
DF

exp(-rT)

T

EXERCISE

Compute the VaR for portfolio with one single stock:

$\pi =$ 

$\Rightarrow$ $\underline{\underline{\text{QE}}}$

(General theoric)

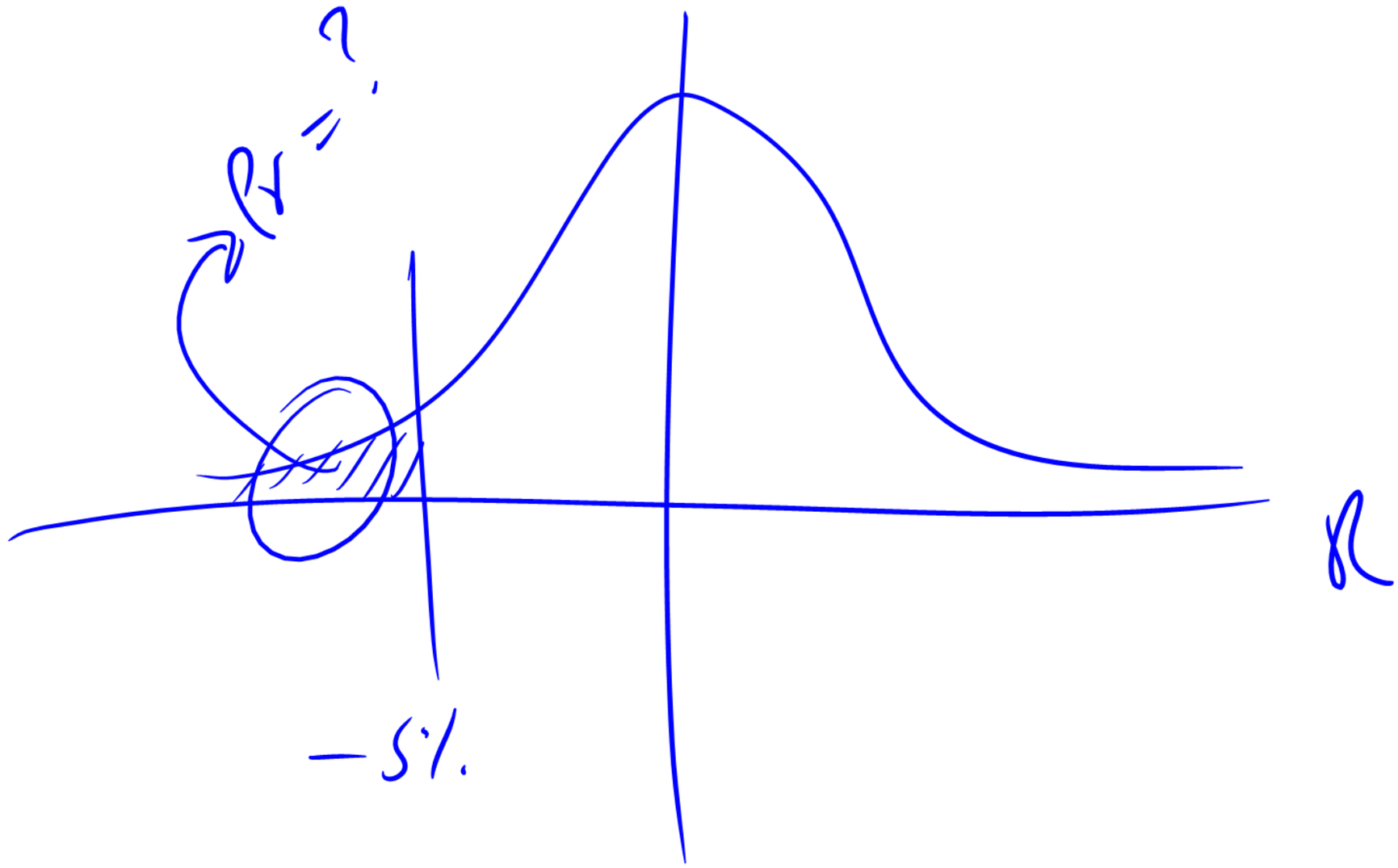
Method:

① Download $\vec{S}$ for last five years (Yahoo finance)

② Compute Daily Returns $\vec{R}$

③ Compute histogram of $\vec{R}$

④ Determine the location (R) of the worst 1% moves.


?
5%
R

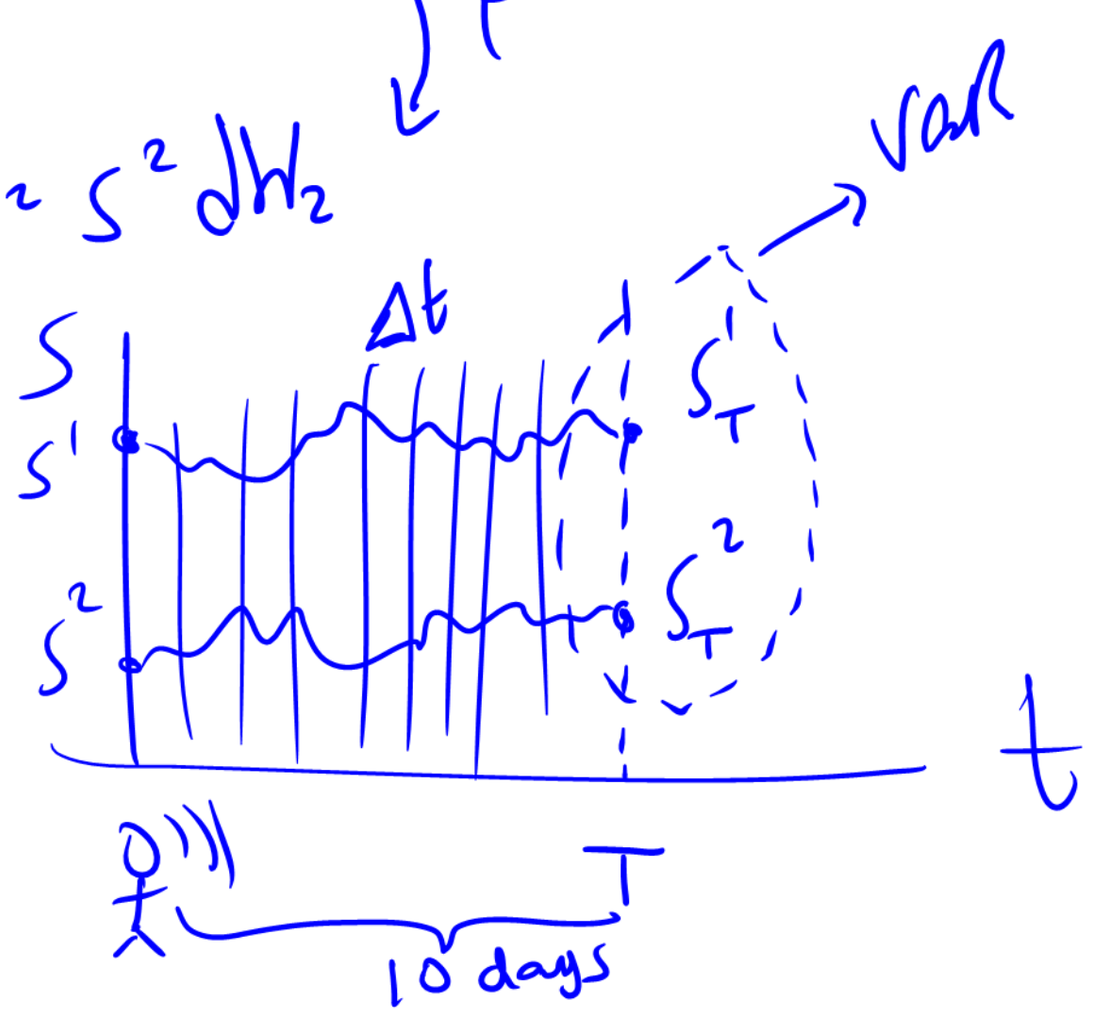
EXERCISE 2

$\pi =$ [S^1, S^2]

cash

$$\begin{cases} dS^1 = \mu^1 S^1 dt + \sigma^1 S^1 dW^1 \\ dS^2 = \mu^2 S^2 dt + \sigma^2 S^2 dW_2 \end{cases}$$

ρ



Euler discretization

$$\mu = r$$

$$dS = \mu S\, dt + \sigma S\, dW$$

$$\downarrow$$

$$\Delta S = \mu S \Delta t + \sigma S \underbrace{\Delta W}$$

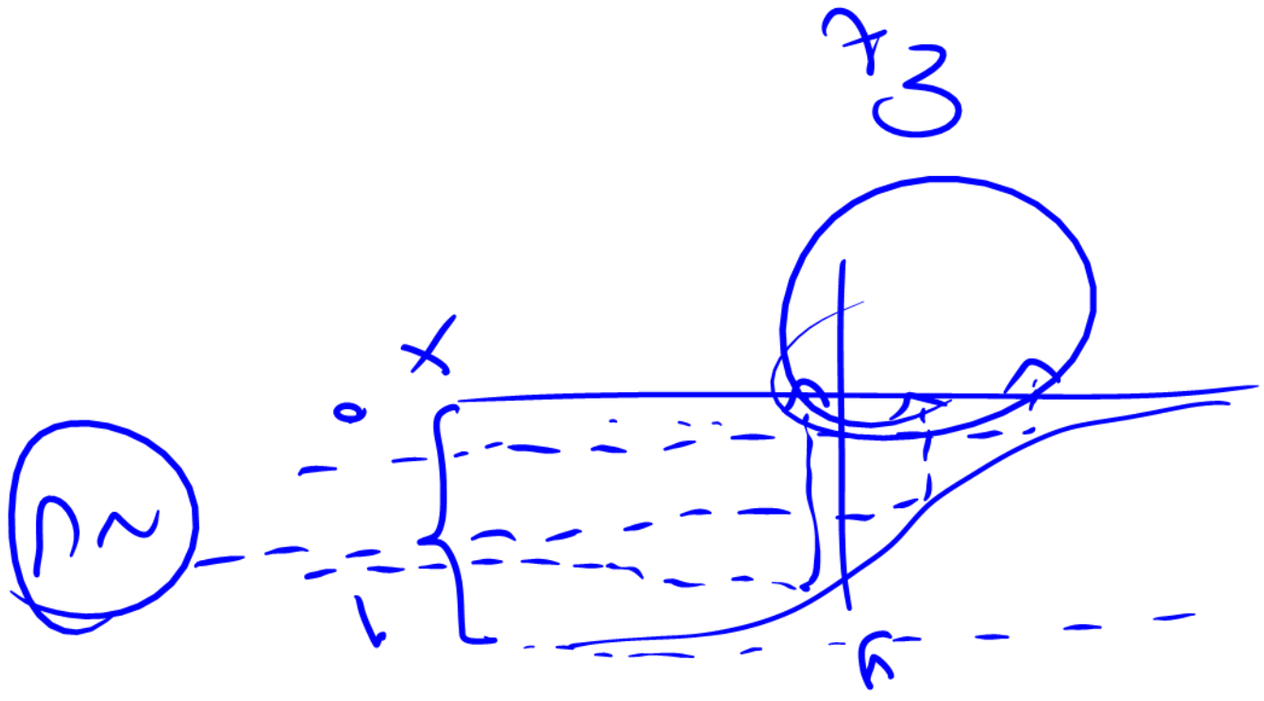
$$S_{t+1} - S_t = \mu S_t \Delta t + \sigma S_t \underbrace{\varepsilon_t \sqrt{\Delta t}}$$

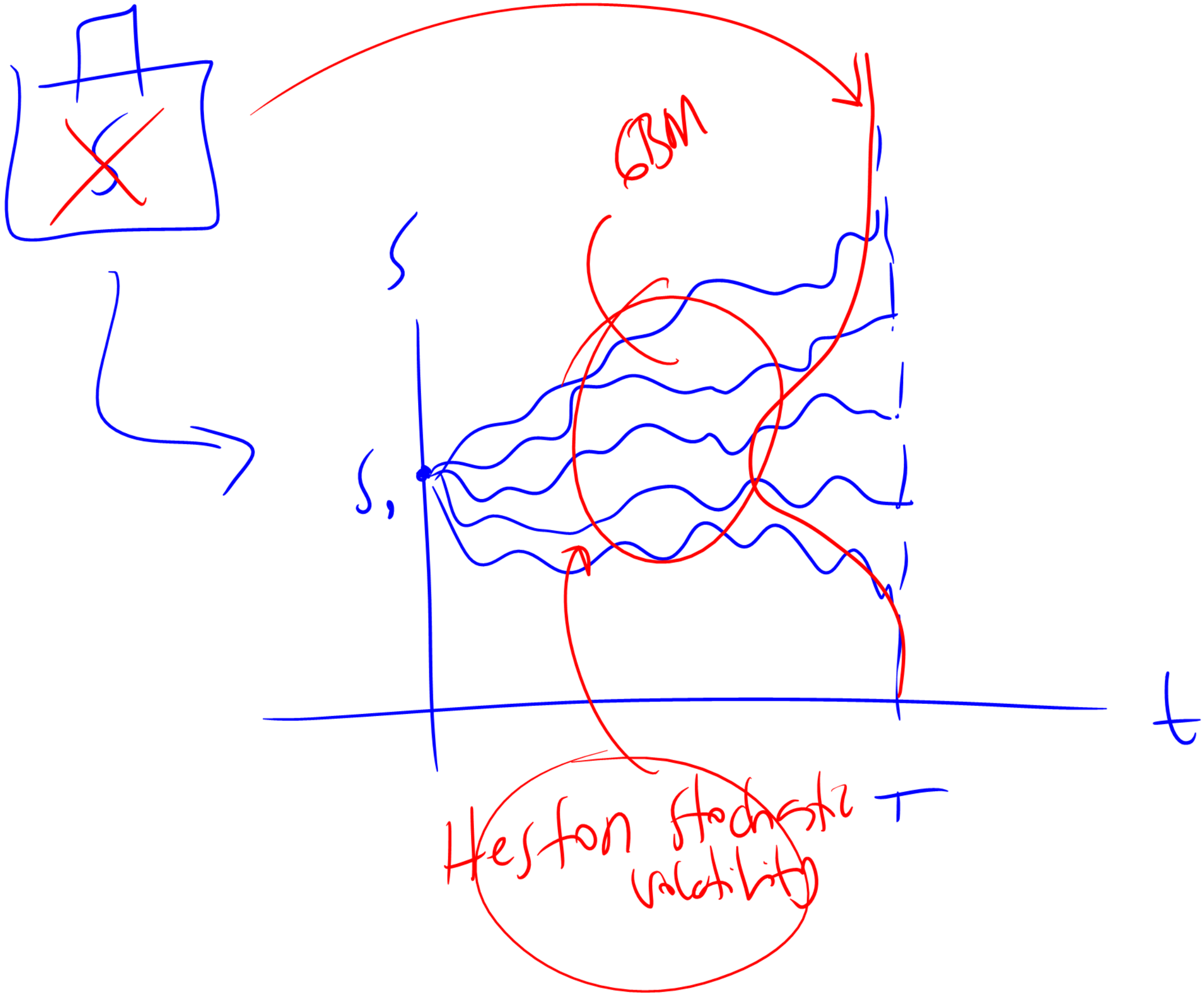
$$S_{t+1} = S_t + \mu S_t \Delta t + \sigma S_t \varepsilon_t \sqrt{\Delta t}$$

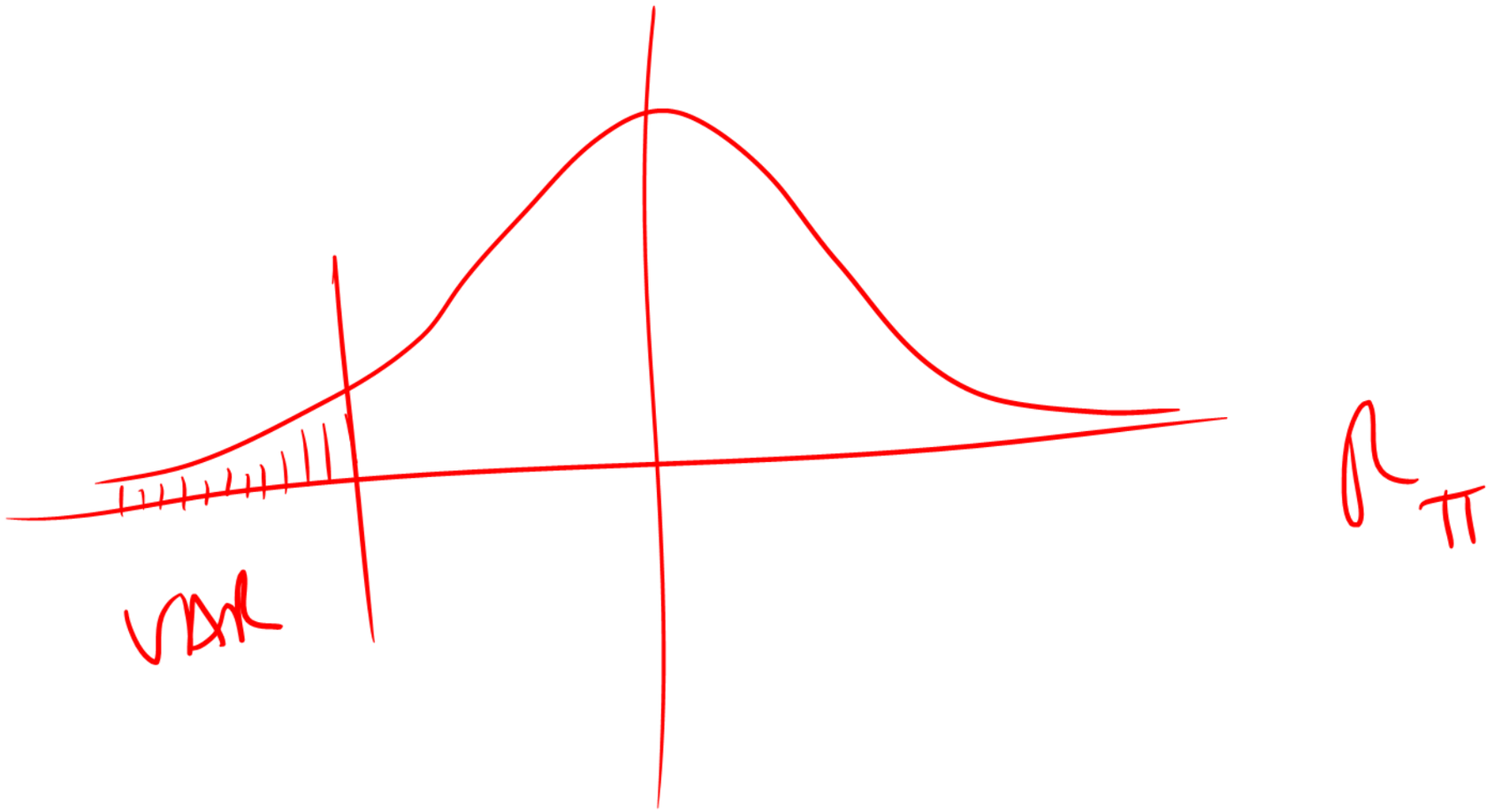
$$S_{t+1} = S_t \left(1 + \mu \Delta t + \sigma \left(\varepsilon_t \sqrt{\Delta t}\right)\right)$$

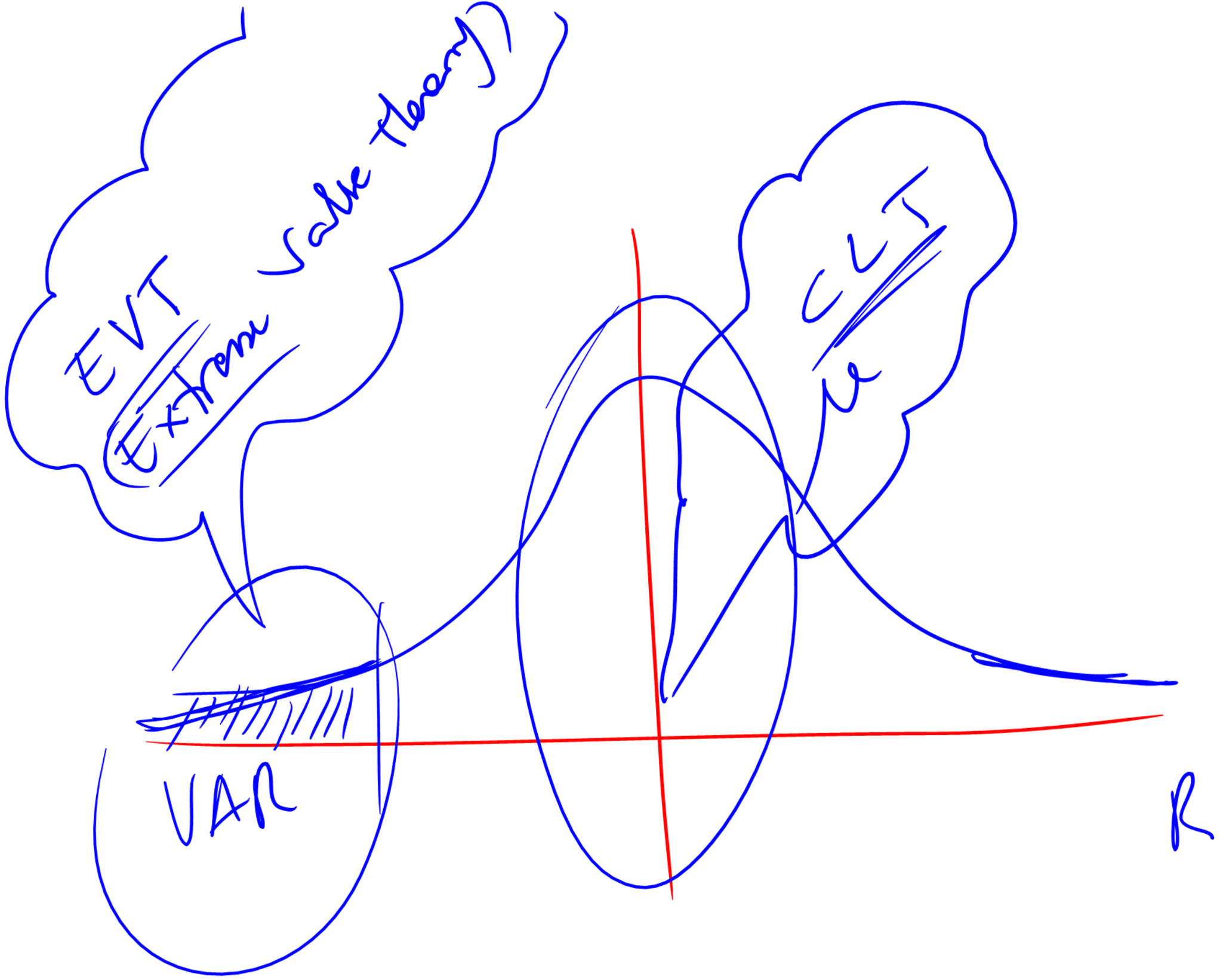
$$\Delta t \simeq \frac{1}{250}$$

ε_t


73
x
0
1
n


BSM
t
Heston stochastic volatility


VaR
R_π


EVT
Extreme value theory
CLT
VAR
R