An in-house solution to cash flow at risk

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Japan Tobacco International

The JT Group

Our parent company

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Our parent company

- JT was established in 1985
- In 1999 JT becomes global with the purchase of the international operations of R.J. Reynolds
- JT Group includes Japan's domestic tobacco market, as well as seasonings, processed foods and pharmaceutical businesses
- JT Group has 44,667 employees worldwide, including JTI
- Around 33% owned by the Japanese government, making it the largest shareholder

Japanese domestic tobacco

IMAGINEERING THE FUTURE MEVIUS

Winston

Processed foods

Pharmaceuticals

Our international business

JTI today

- JTI is the JT Group's international tobacco business
- We employ people in 72 countries around the world
- We are a leading international tobacco product company created in 1999
- We sold 398.7 billion cigarettes[1]
- The Company's core revenue was USD 10,490 million[1]

Approximately
27,000
employees

399
offices

25
factories

9
research & development centers

5
tobacco processing facilities

1 Jan–Dec 2016

Figures as of December 2016

Our Global Flagship Brand portfolio

Our world renowned Flagship Brands accounted for over 71% of tobacco sales volume

Winston

MEVIUS
CAMEL
LD Liggett Ducat

BENSON & HEDGES
NATURAL AMERICAN SPIRIT
SOBRANIE LONDON
Glamour
SILK CUT

Our ‘Other Tobacco Products’ and ‘Next-Generation Products’

Roll-your-own, make-your-own

OLD HOLBORN | AMBER LEAF | DOMINGO | Fleur du Pays

Cigars

Snus

LD

Shisha

NAKHLA
SINCE 1913

E-cigarettes

logic.

Rechargeable and tank-style e-cigarettes

Tobacco Vapor

ploom
the future is plooming

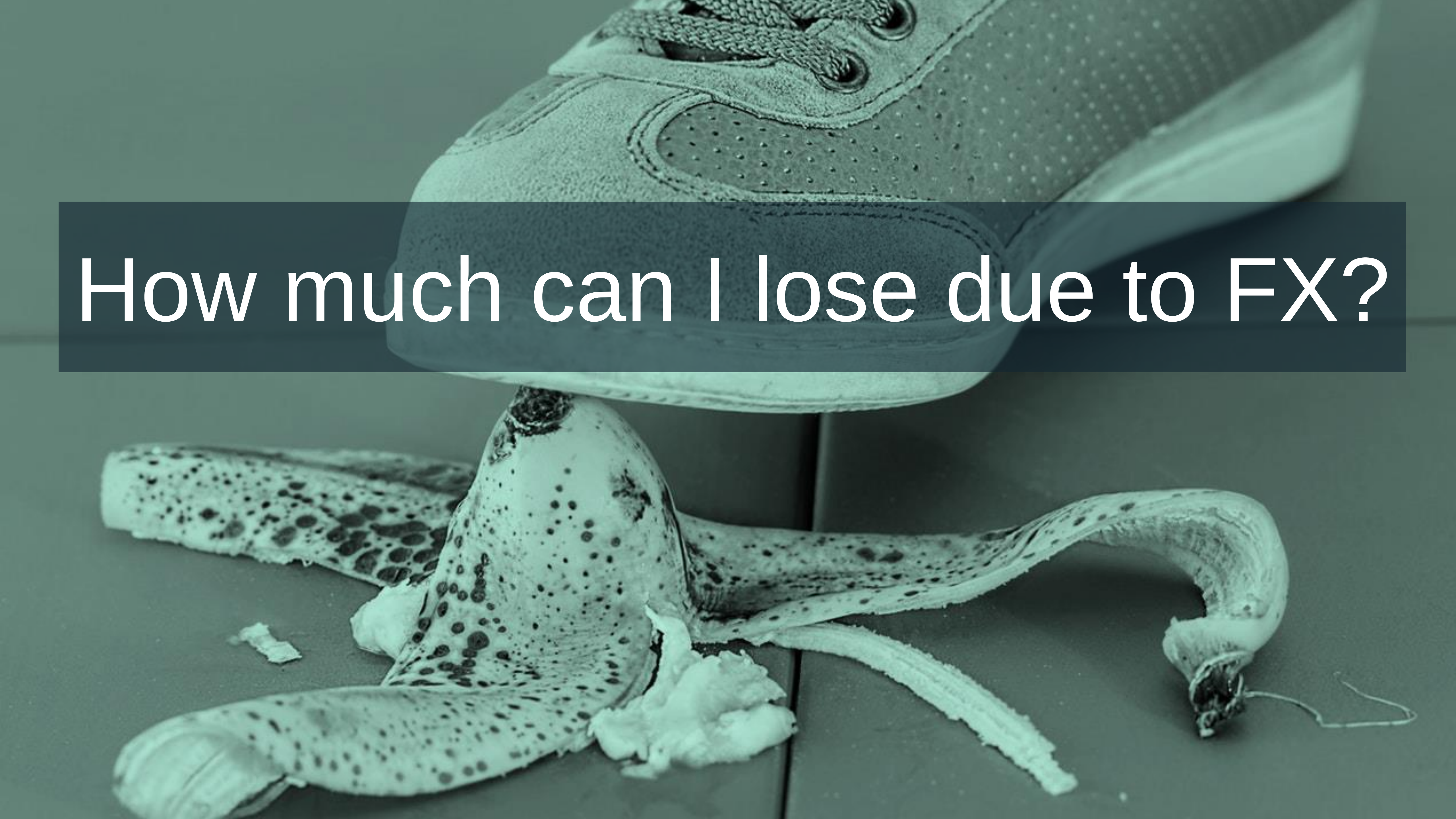
HR practices recognized globally

Global Top Employer

- JTI was certified Global Top Employer by the Top Employers Institute
- Awarded for the third consecutive year
- In 33 countries in 2017
- Our international headquarters also recognized as the number one employer in Switzerland.

Investors in people

- Accredited locally in a number of countries.


How much can I lose due to FX?

Cash Flow at Risk:

Measure of the potential maximum loss in the value of expected cash flows resulting from an adverse market move, within a given confidence level for the given time horizon.

Basic example

Statement

- USD functional company
- 1 MM EUR inflow in 6 months
- 50 MM RUB inflow in 6 months
- EURUSD rate 1.19
- USDRUB rate 57.48

Expected cash flow : $2.06 MM

How to calculate CFaR?

Common methods

Historical Method

Parametric Method

Monte Carlo Method

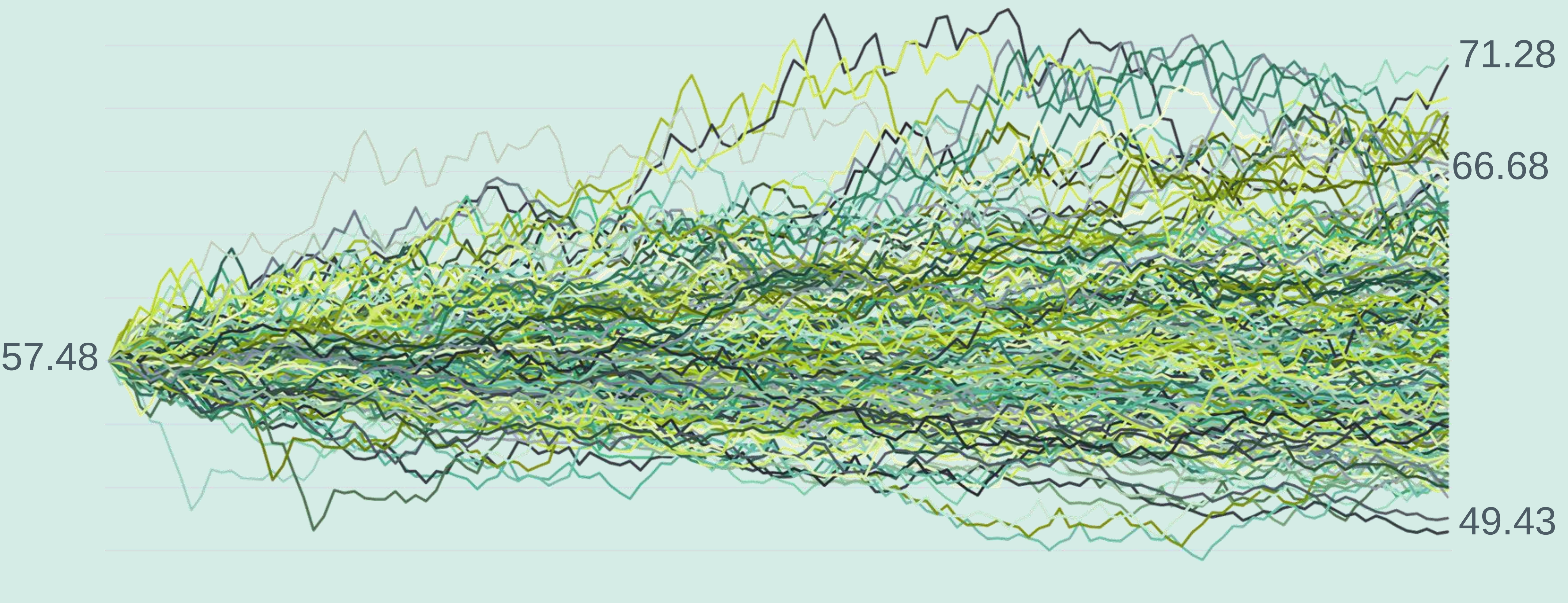
Historical method:

Look at the past to forecast the future.

Historical method

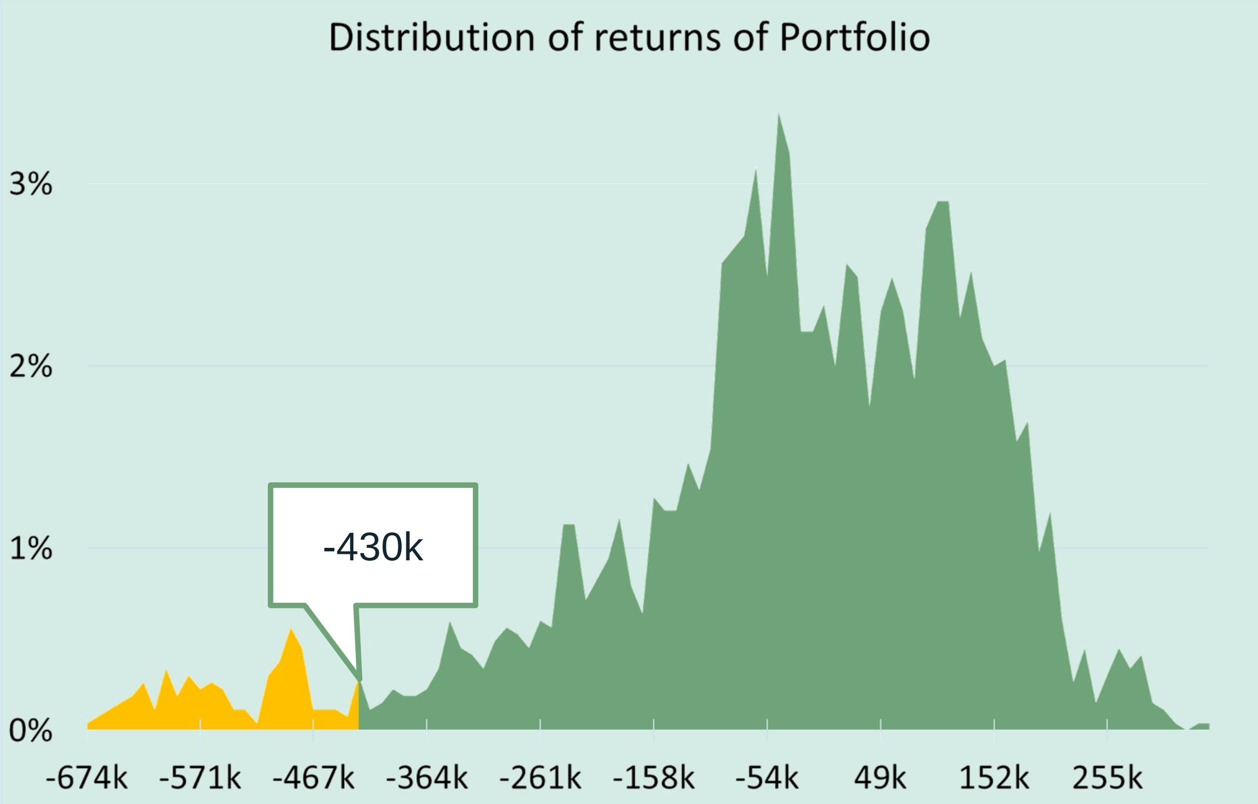
Observed past returns

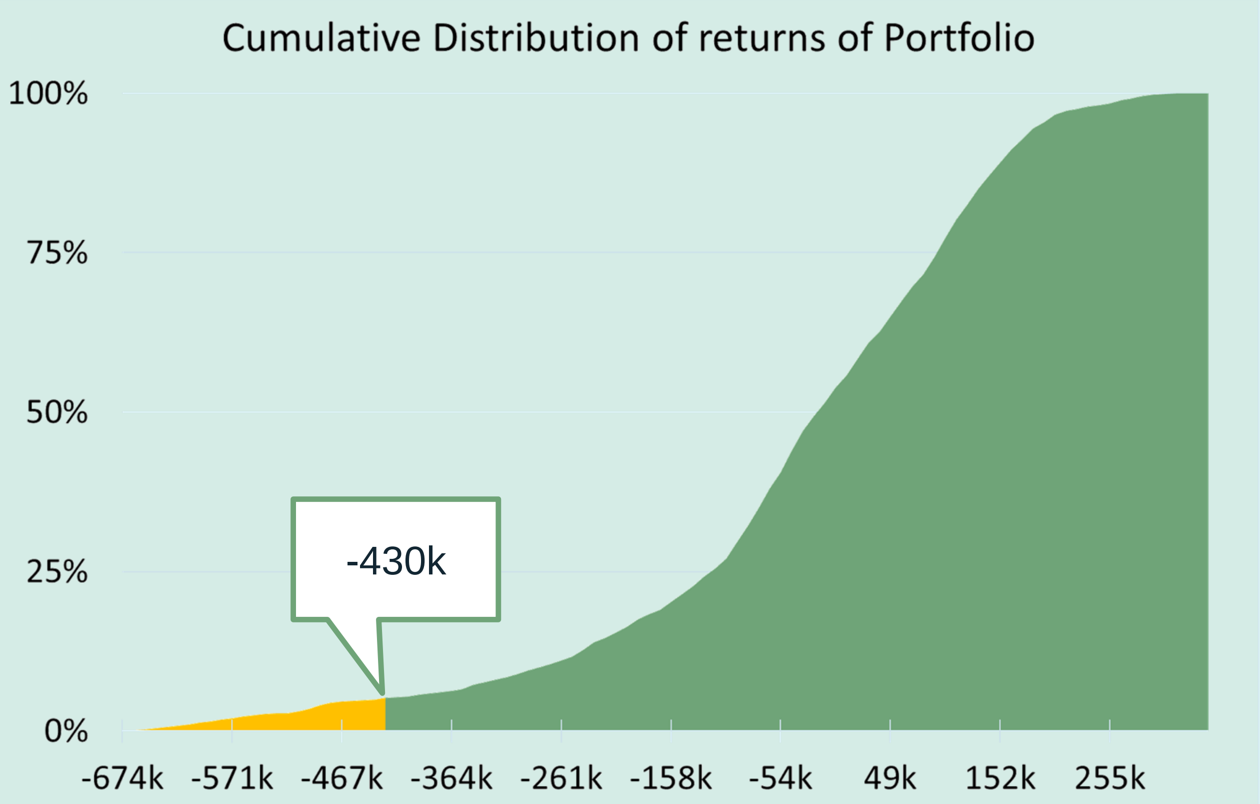
Historical method



Historical method - results

10 years of history





Parametric method:

Use probability theory to compute a portfolio's maximum loss.

Parametric method

Formula and concept

Assume the currency pairs returns follow a normal distribution.

the left tail α−percentile of a standard normal distribution

Volatility

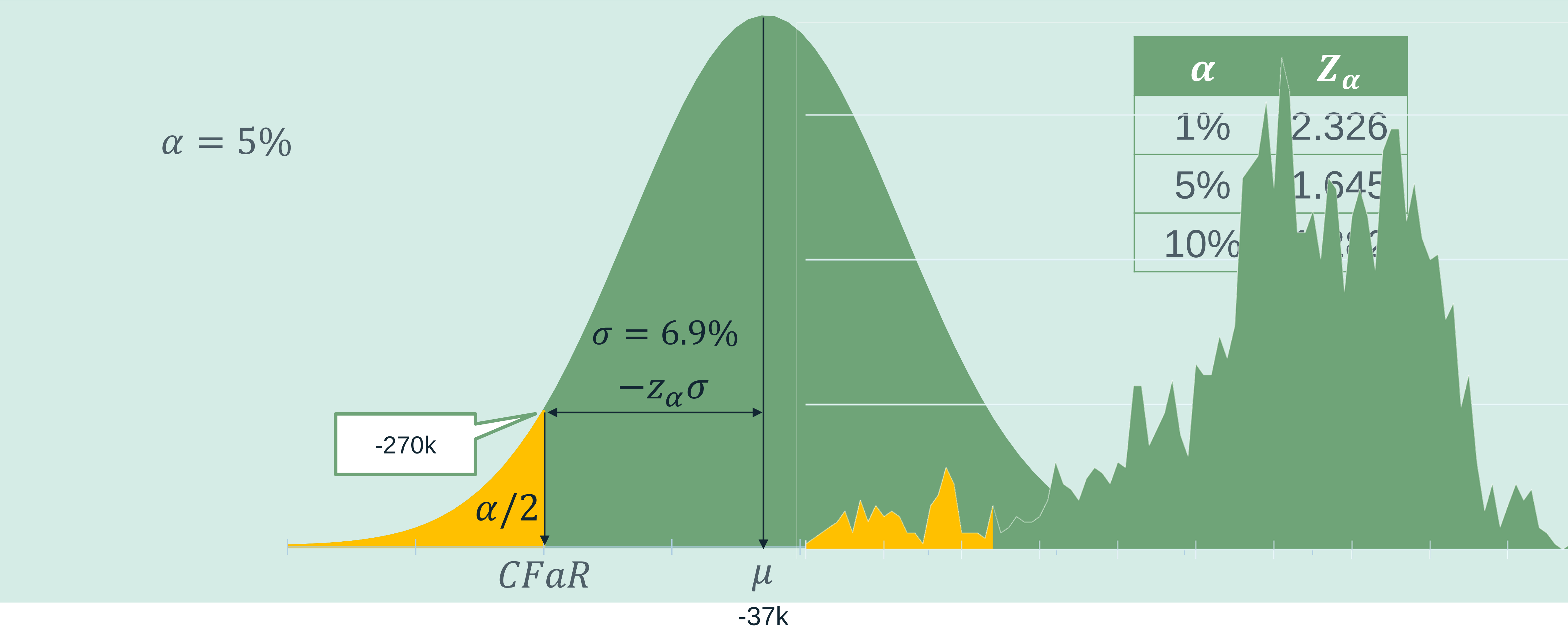
$$CFaR = (\mu - z_{\alpha} \times \sigma) \times P$$

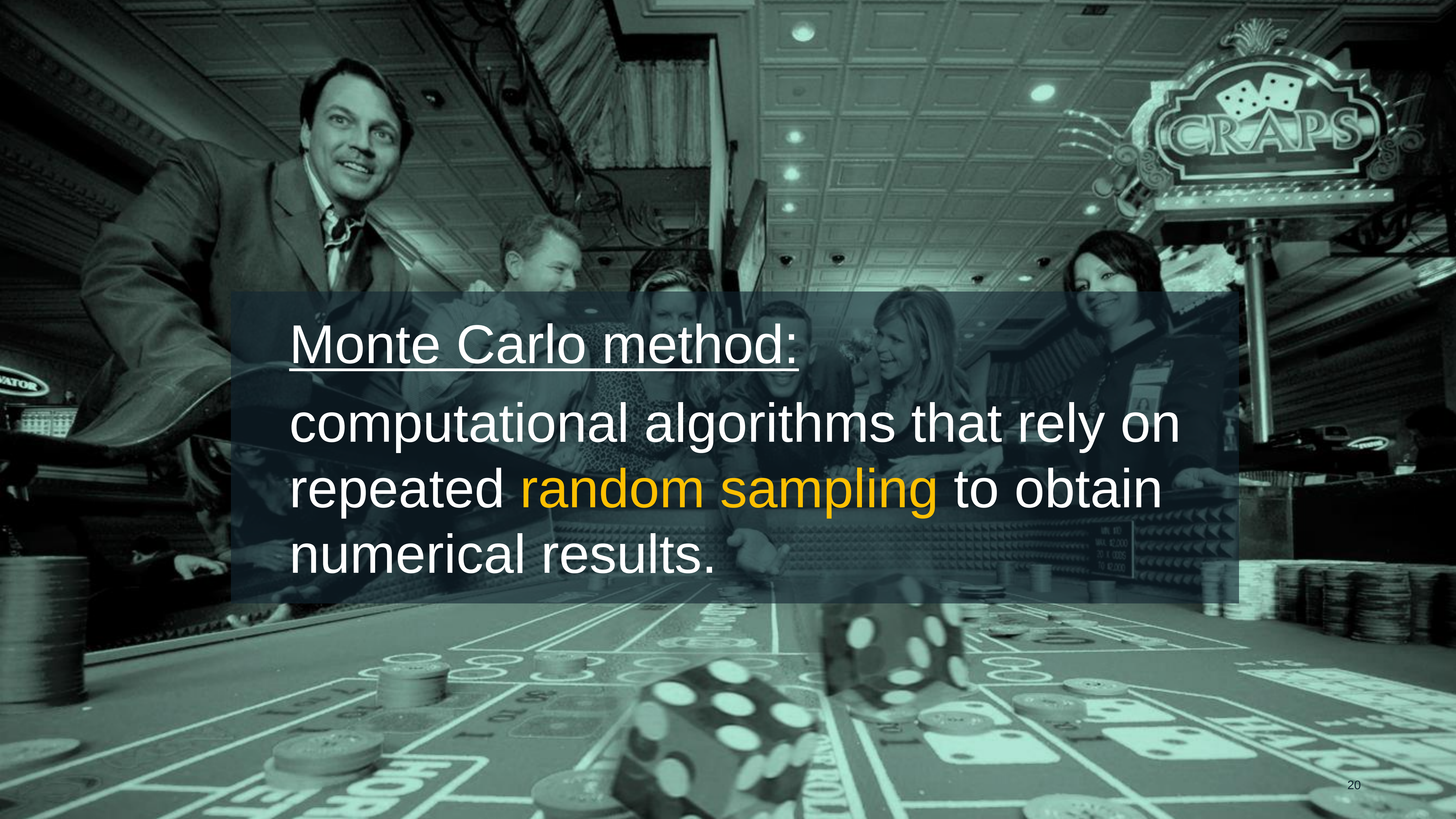
Drift

Portfolio value

Parametric method

Formula and concept





Monte Carlo method:

computational algorithms that rely on repeated random sampling to obtain numerical results.

Monte Carlo method

Formula and concept

Assume asset prices follow a geometric Brownian motion.

$$S_{t+\Delta t} = S_t e^{(k\Delta t + \sigma \varepsilon_t \sqrt{\Delta t})}$$

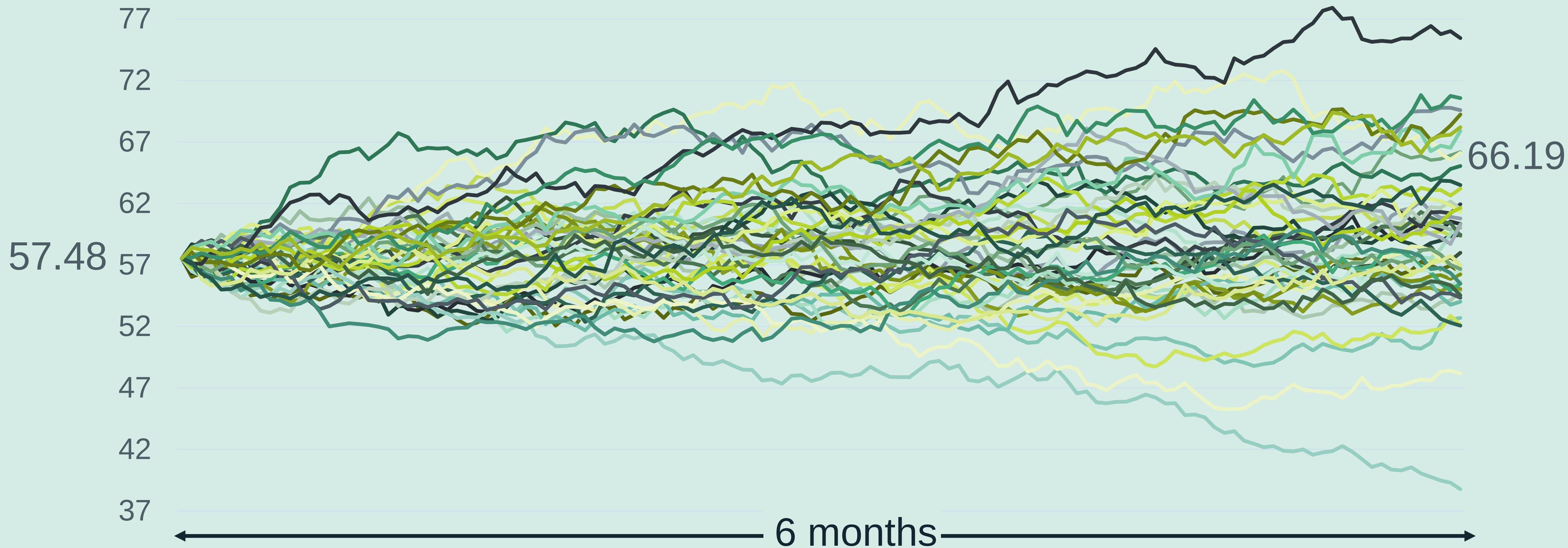
- $S_{t+\Delta t}$: *Simulated spot*
- S_t: *Spot*
- k: *Expected return*
- σ: *Volatility*
- ε_t: *Random element*

$$k = \mu - \frac{\sigma^2}{2}$$

- μ: *Drift*
- σ: *Volatility*

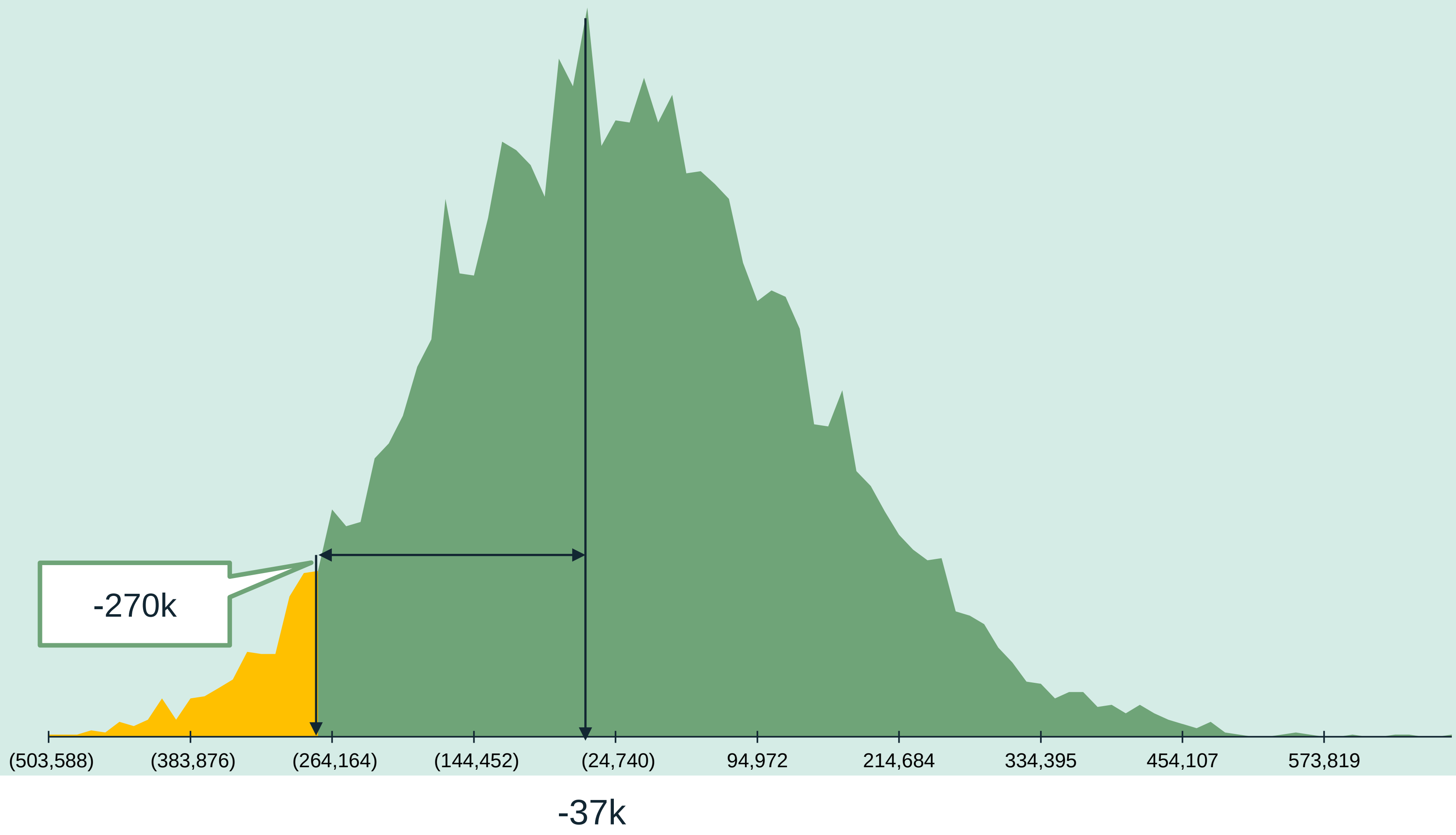
Monte Carlo method

Generate future returns



Monte Carlo method

Results with 10000 simulations



Method	Pros	Cons
	• Simple • Fact-based	• Will history repeat?
	• Simple • One formula	• Limited to linear returns • Path-independent
	• Powerful • Can model scenarios	• Difficult to implement • Resource heavy

Appendix

Low cost solution

Inputs

FX returns

Return $r_{t+\Delta t} = \frac{S_{t+\Delta t} - S_t}{S_t}$

Drift

- *Average return on the period*
- $\mu = \sqrt[n]{\prod_1^n (r_i + 1)} - 1$

Volatility

- *Standard deviation of returns*
- $\sigma = \sqrt{\frac{1}{n-1} \sum_1^n (r_i - \mu)^2}$

Low cost solution

In Excel

FX returns

- In cell B2 : “=(A2-A1)/A1”
- Drag formula until B10

Drift

- In cell C2 : “=B2+1” and drag to C10
- In cell E2 : “=PRODUCT(C2:C10)^(1/COUNT(C2:C10))-1

Volatility

- In cell D2 : “=(C2-E2)^2” and drag to D10
- In cell F2 =“SQRT(SUM(D2:D10)/(COUNT(D2:D10)-1))

Parametric method

Multi asset portfolio

$$CFaR = (\mu - z_\alpha \times \sigma) \times P \qquad \mu = \sum w_i \mu_i$$

$$\sigma = \sqrt{\begin{bmatrix} w_1 & \cdots & w_n \end{bmatrix} \begin{bmatrix} \sigma_1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & \sigma_n \end{bmatrix} \begin{bmatrix} 1 & \cdots & \rho_{n,1} \\ \vdots & 1 & \vdots \\ \rho_{1,n} & \cdots & 1 \end{bmatrix} \begin{bmatrix} \sigma_1 & 0 & 0 \\ 0 & \ddots & 0 \\ 0 & 0 & \sigma_n \end{bmatrix} \begin{bmatrix} w_1 \\ \vdots \\ w_n \end{bmatrix}}$$

$$with\ w_i\ the\ weight\ of\ the\ i-th\ asset\ of\ the\ portfolio$$
$$and\ \rho_{i,j}\ the\ correlation\ between\ i-th\ and\ j-th\ assets$$

Monte Carlo method

Multi asset portfolio

$$S_{t+\Delta t} = S_t e^{(k+\sigma\varepsilon_t)}$$

$$Cholesky\ decomposition\ of\ Correlation\ Matrix\ M = LL^*$$

$$M = LL^* \Leftrightarrow \begin{bmatrix} 1 & \dots & \rho_{n,1} \\ \vdots & 1 & \vdots \\ \rho_{1,n} & \cdots & 1 \end{bmatrix} = \begin{bmatrix} L_{1,1} & 0 & 0 \\ \vdots & L_{i,i} & 0 \\ L_{n,1} & \cdots & L_{n,n} \end{bmatrix} \begin{bmatrix} L_{1,1} & \cdots & L_{n,1} \\ 0 & L_{i,i} & \vdots \\ 0 & 0 & L_{n,n} \end{bmatrix}$$

$$\varepsilon_t = [\varepsilon_{EUR,t} \quad \dots \quad \varepsilon_{USD,t}] = [\alpha_1 \quad \dots \quad \alpha_n]L$$

$$with\ \alpha_i = NORMINV(RAND(), 0,1)$$

$$S_{t+\Delta t} = S_t e^{(\mu - \frac{\sigma^2}{2} + \sigma\varepsilon_{currency,t})}$$

Enterprising
Open
Challenging