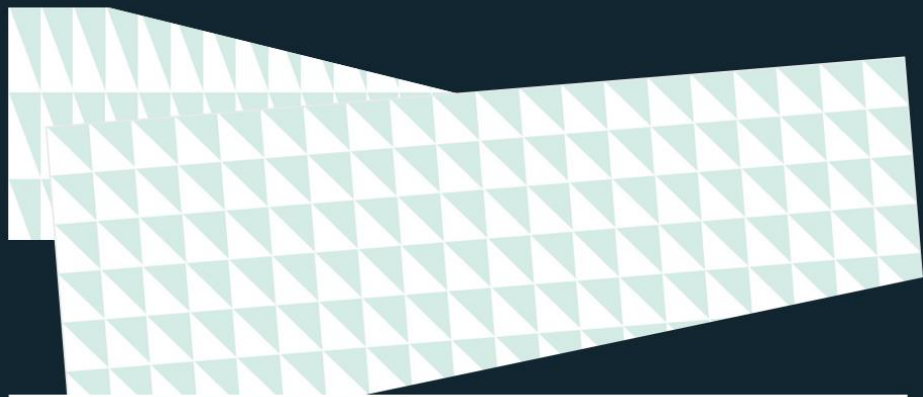


# An in-house solution to cash flow at risk

*Vincent Delort*

*June 14<sup>th</sup>, 2018*

*Japan Tobacco International*





# The JT Group

*Our parent company*

# The JT Group

*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



---

## 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<sup>1</sup>
- The Company's core revenue was USD 10,490 million<sup>1</sup>

Approximately

**27,000**

employees

**399**  
offices

**25**  
factories

**9**  
research & development  
centers

**5**  
tobacco processing  
facilities

<sup>1</sup> 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*



# Our 'Other Tobacco Products' and 'Next-Generation Products'

---

Roll-your-own, make-your-own



---

Cigars



Snus



Shisha



---

E-cigarettes



Rechargeable and tank-style e-cigarettes



Tobacco Vapor



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.





A close-up photograph of a grey sneaker with white laces and a white sole, positioned as if about to step on a banana peel. The banana peel is cracked and broken, with some pulp visible. The background is a dark, textured surface. A semi-transparent dark blue banner is overlaid across the middle of the image, containing white text.

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

---



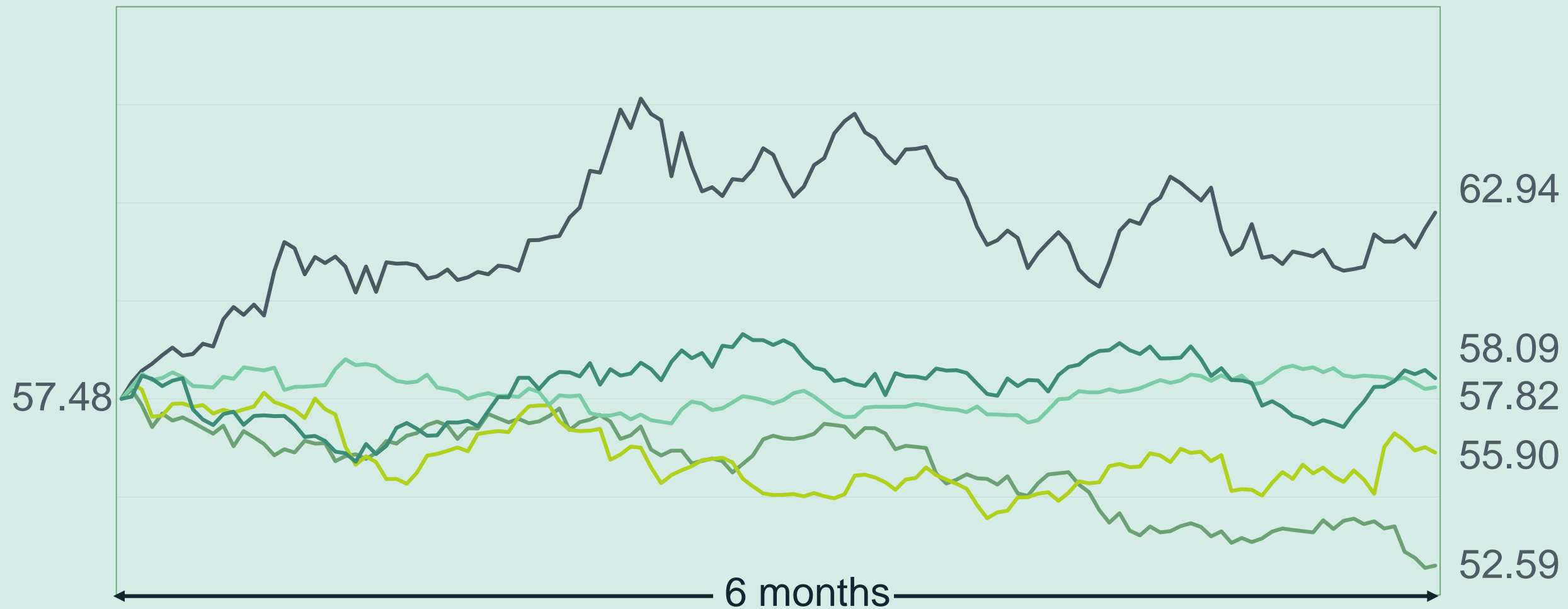
Monte Carlo Method

A low-angle photograph of ancient Greek temple ruins, featuring several tall, fluted columns and a section of the entablature against a cloudy sky. The image has a teal/cyan color cast.

Historical method:  
Look at the past to forecast the future.

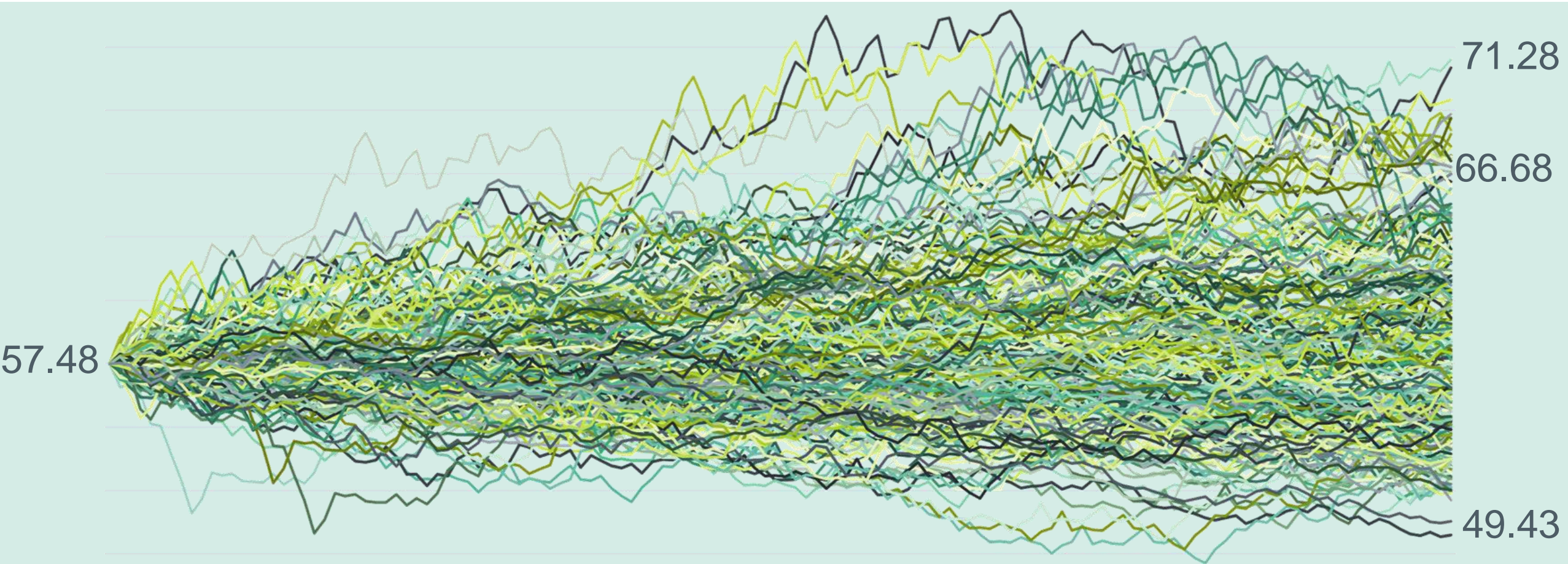
# Historical method

*Observed past returns*





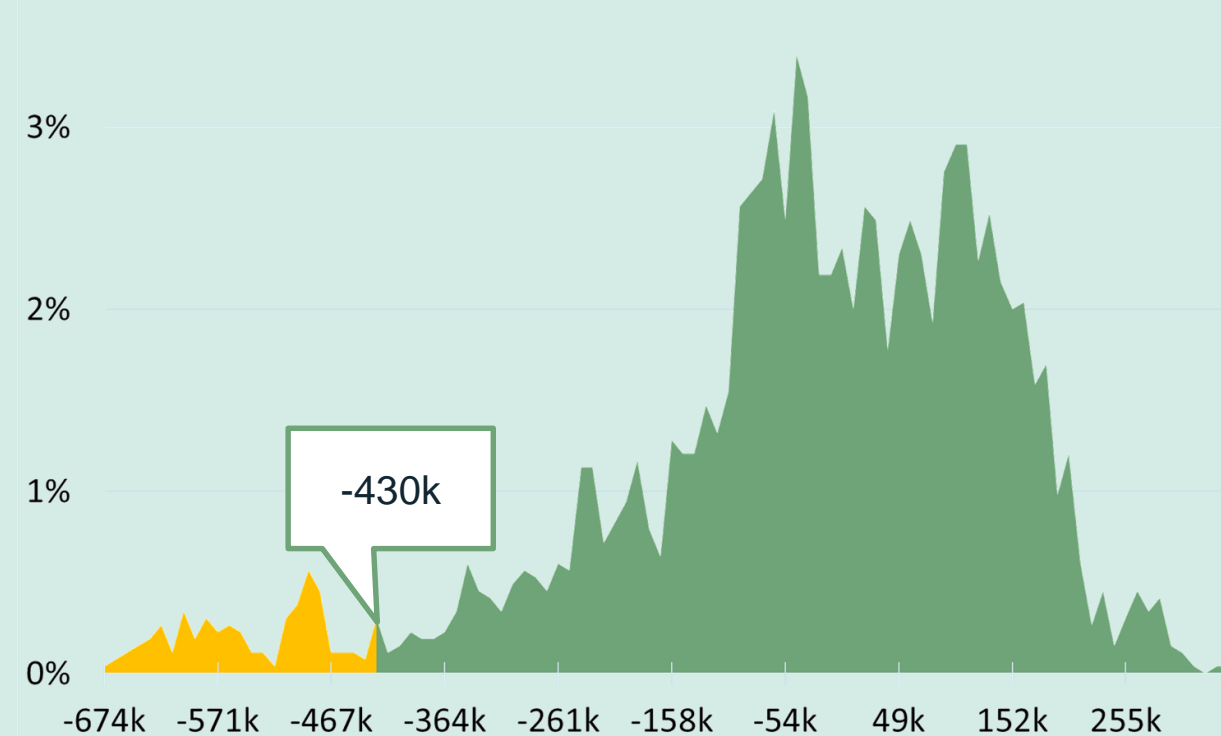
# Historical method



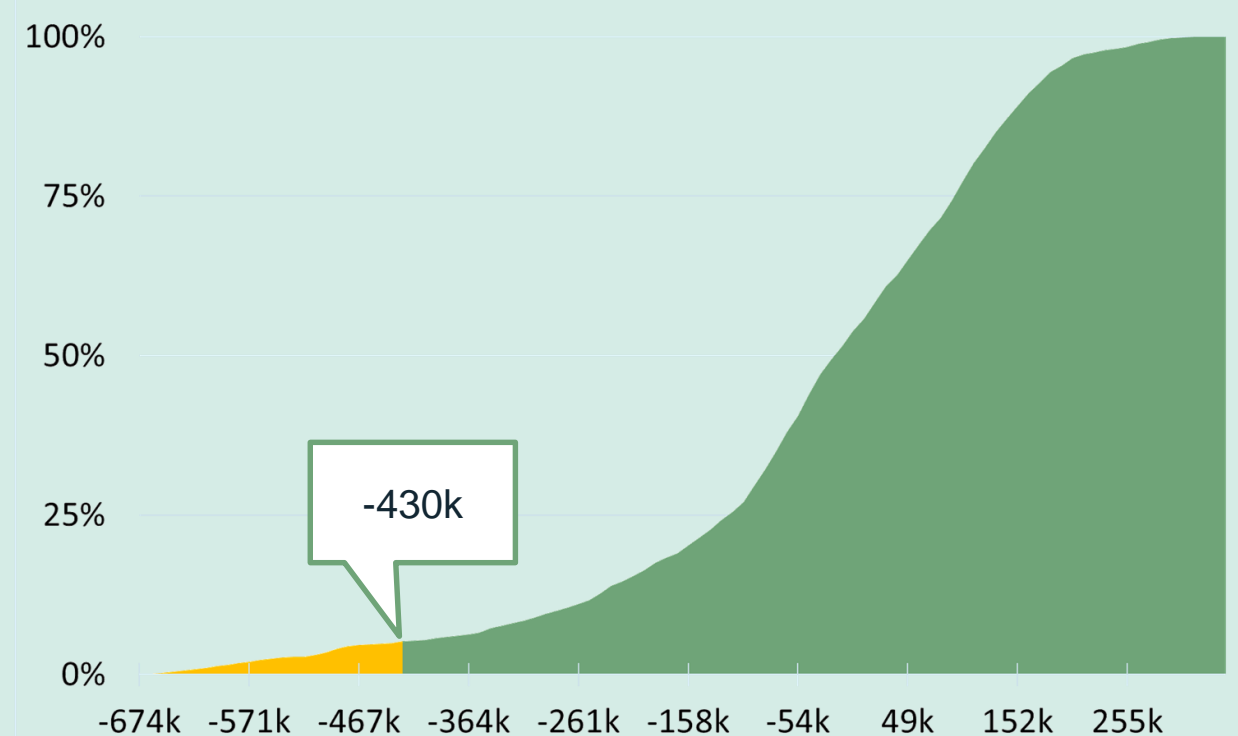
# Historical method - results

*10 years of history*

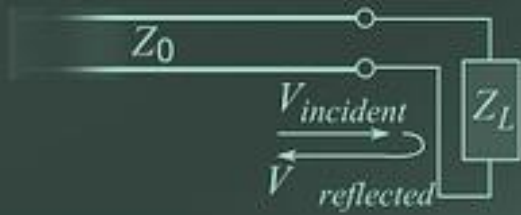
Distribution of returns of Portfolio



Cumulative Distribution of returns of Portfolio







$$z = \frac{Z_L}{Z_0}$$

$$\Gamma = \frac{V_{\text{reflected}}}{V_{\text{incident}}}$$

$$\frac{a}{b+c} = a \div (b+c) \neq \frac{a}{b} + \frac{a}{c}$$

Parametric method:

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

$$a \times b$$

$$P = 2\ell + 2w$$

$b$

$$|a \times b|$$

$\theta$

$x$

$l$

$\sqrt{l^2}$

$1$

$c$

$y$

$q$

$O$

$\vec{r}$

$\alpha$

$\vec{dr}$

$\vec{E}_{\text{stat}}$

# Parametric method

## *Formula and concept*

Assume the currency pairs returns follow a normal distribution.

The diagram shows the CFaR formula with four callout boxes explaining its parts:

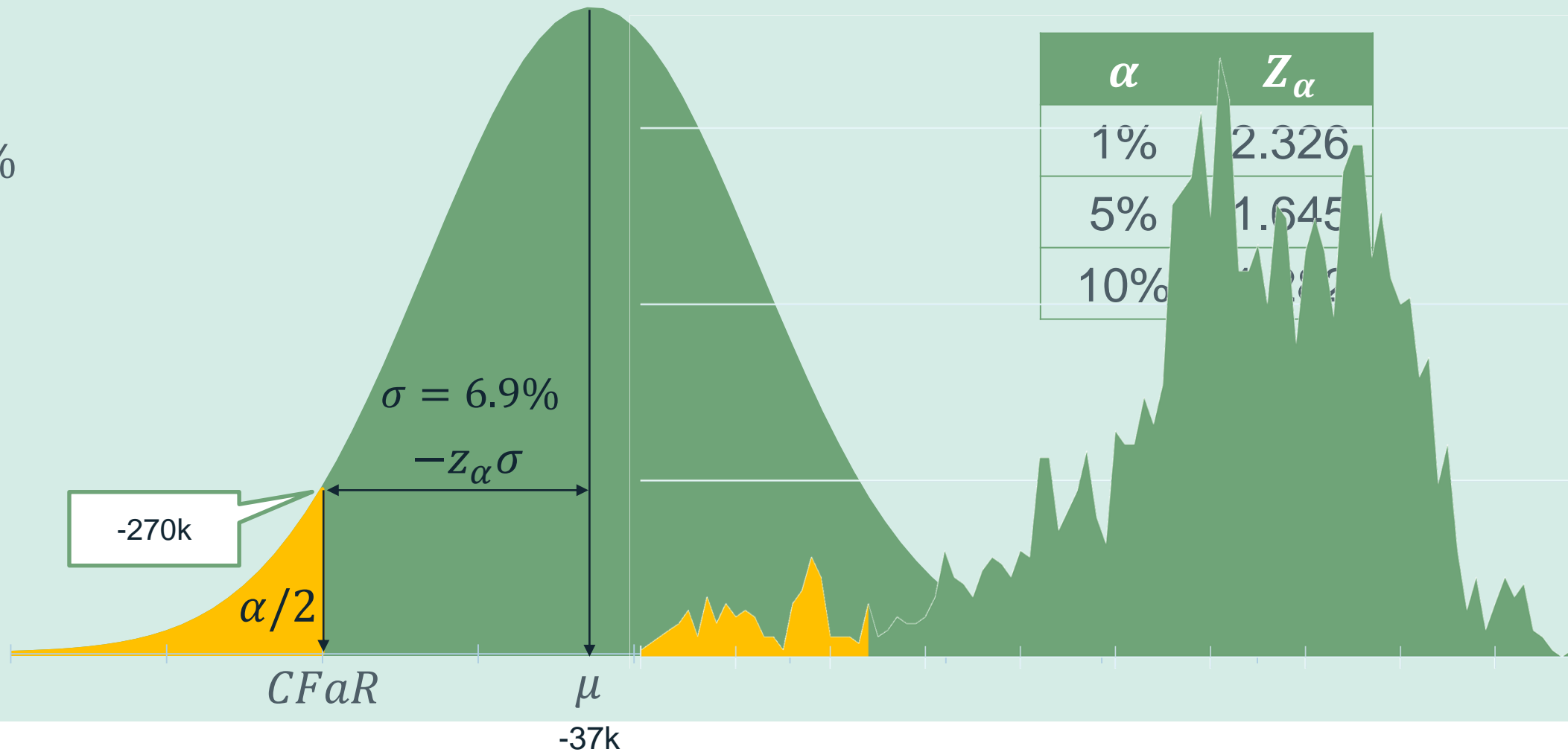
- A box pointing to  $z_\alpha$  contains the text: *the left tail  $\alpha$ -percentile of a standard normal distribution*
- A box pointing to  $\sigma$  contains the text: *Volatility*
- A box pointing to  $\mu$  contains the text: *Drift*
- A box pointing to  $P$  contains the text: *Portfolio value*

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

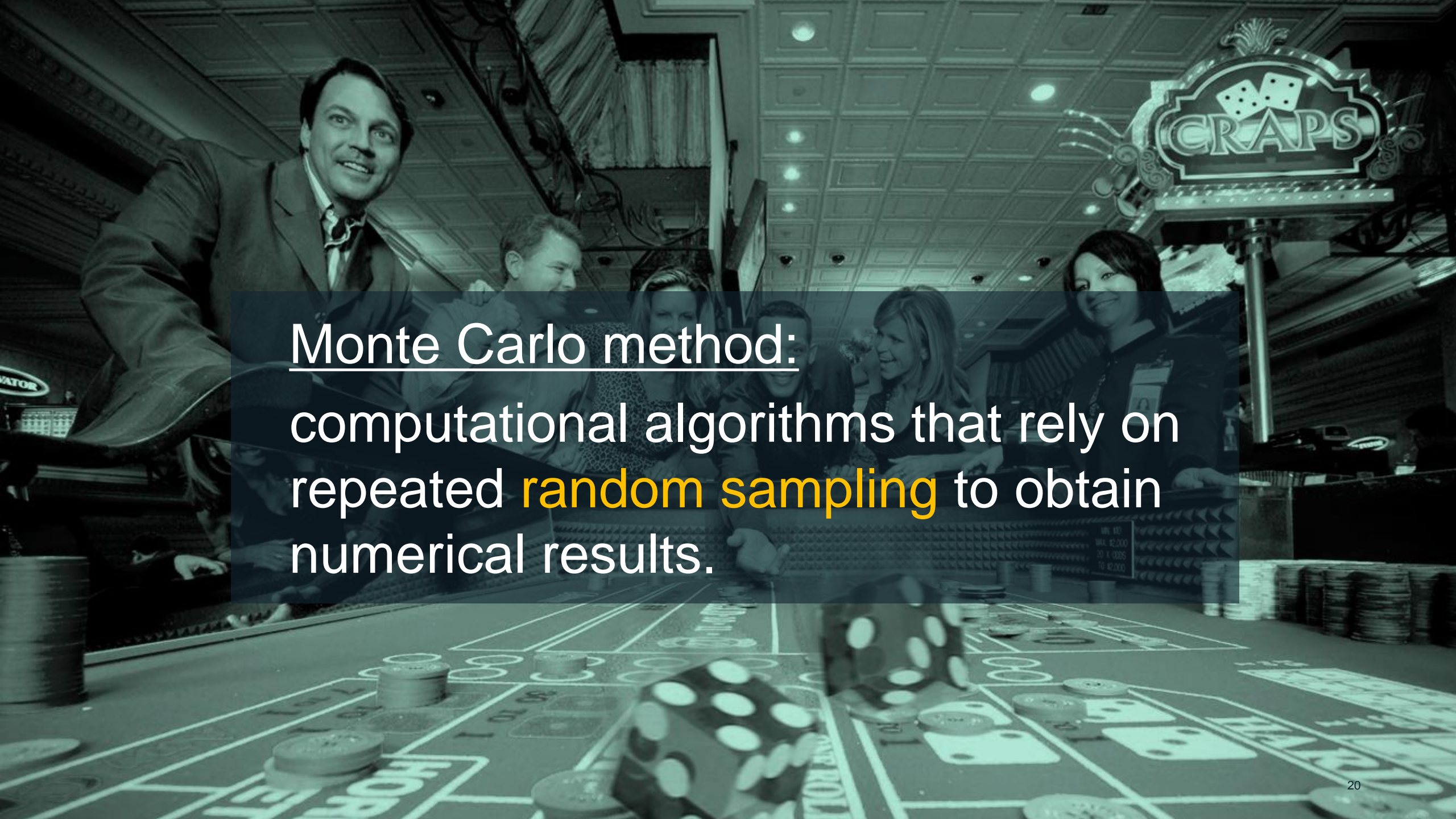
# Parametric method

## *Formula and concept*

$\alpha = 5\%$







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.

The diagram illustrates the formula for geometric Brownian motion,  $S_{t+\Delta t} = S_t e^{(k\Delta t + \sigma \varepsilon_t \sqrt{\Delta t})}$ , and the drift adjustment formula,  $k = \mu - \frac{\sigma^2}{2}$ . Each term in the formulas is enclosed in a green-bordered box with a callout line pointing to its corresponding part of the equation.

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

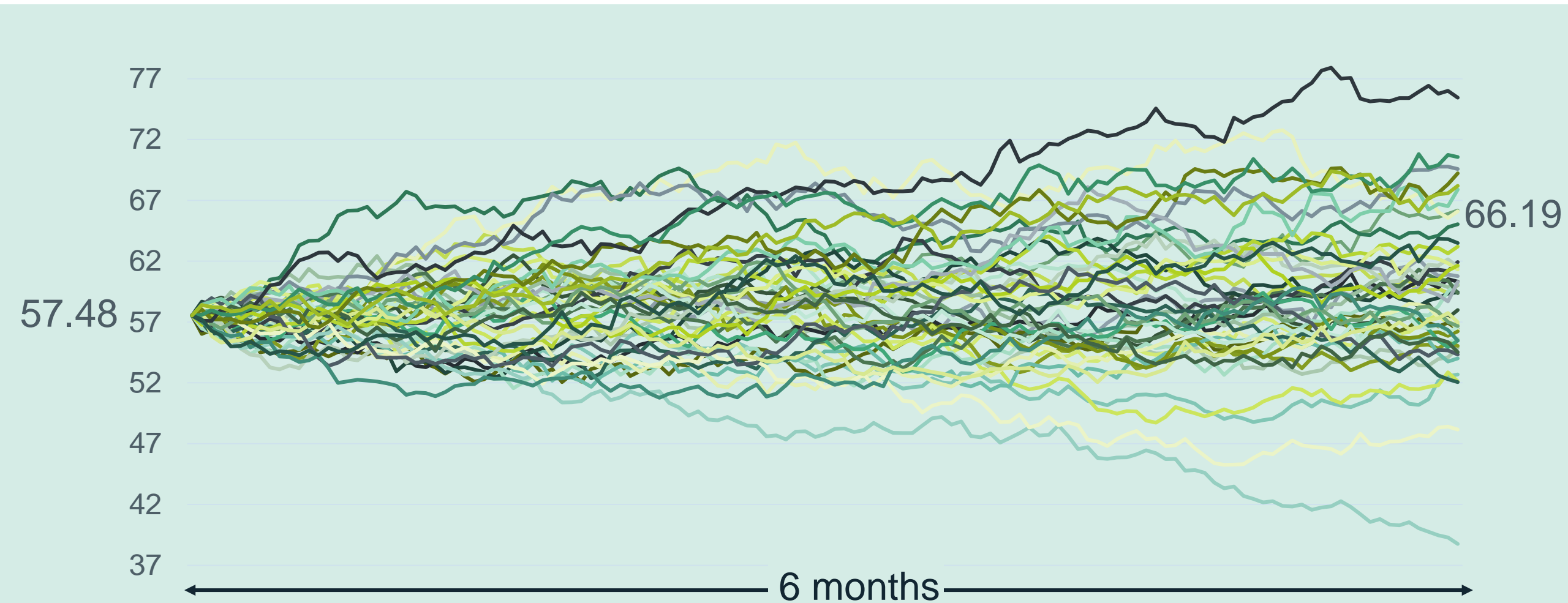
- Simulated spot:**  $S_{t+\Delta t}$
- Spot:**  $S_t$
- Expected return:**  $k$
- Volatility:**  $\sigma$
- Random element:**  $\varepsilon_t$

**Right Formula:**  $k = \mu - \frac{\sigma^2}{2}$

- Drift:**  $\mu$
- Volatility:**  $\sigma$

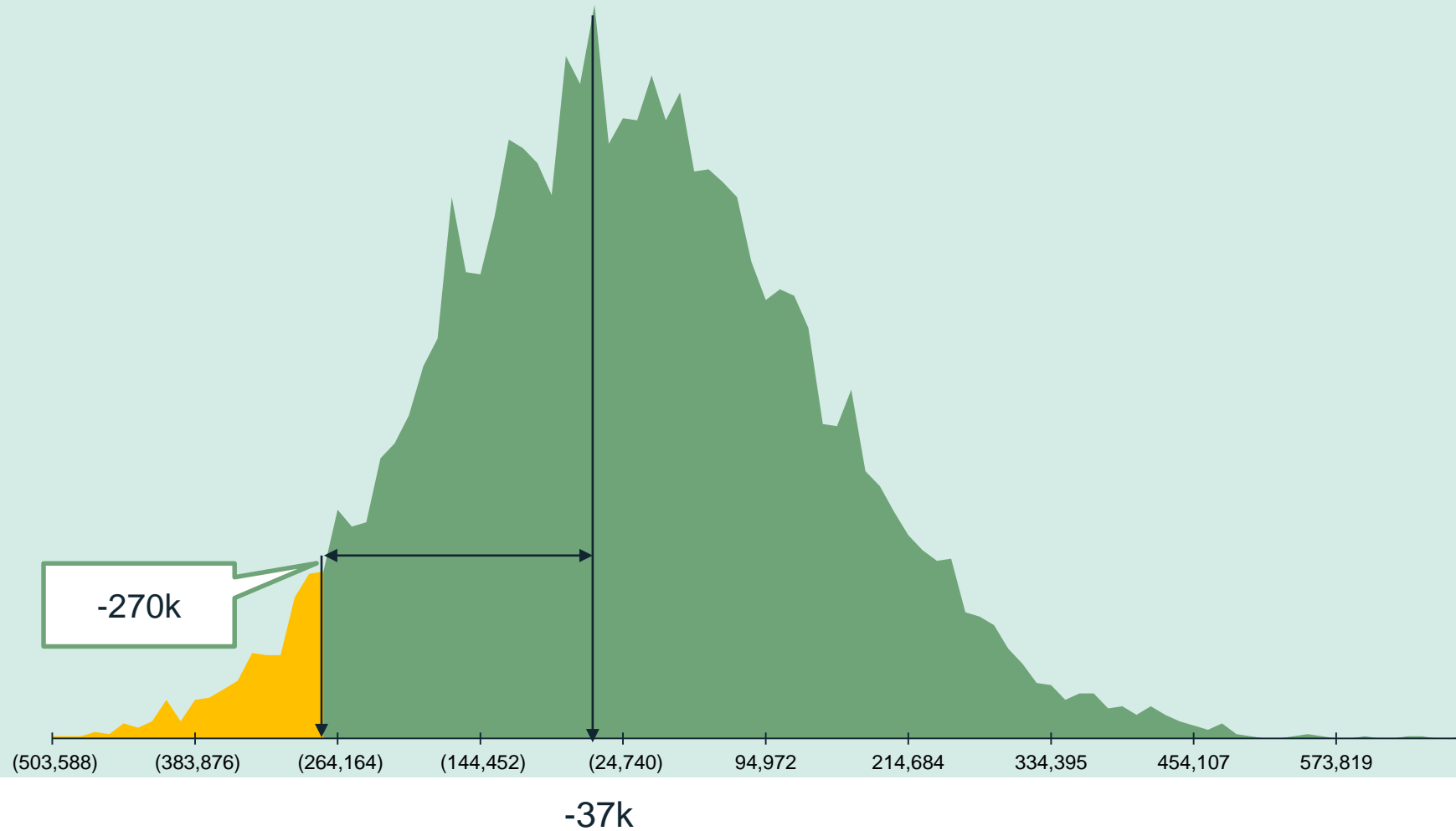
# Monte Carlo method

*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



The background of the slide is a dense, repeating pattern of overlapping squares. Each square is divided into a 4x4 grid. Some squares are solid black with a white 'X' in the center, while others are white with a black 'X' in the center. The squares are arranged in a way that they overlap, creating a complex, textured effect.

# Appendix



# Low cost solution

## *Inputs*



FX returns

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



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**-\$**E\$2**)^2” and drag to D10
- In cell **F2** =“SQRT(SUM(**D2:D10**)/(COUNT(**D2:D10**)-1))

# Parametric method

*Multi asset portfolio*

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

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

*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  $M = LL^*$*

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

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

*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