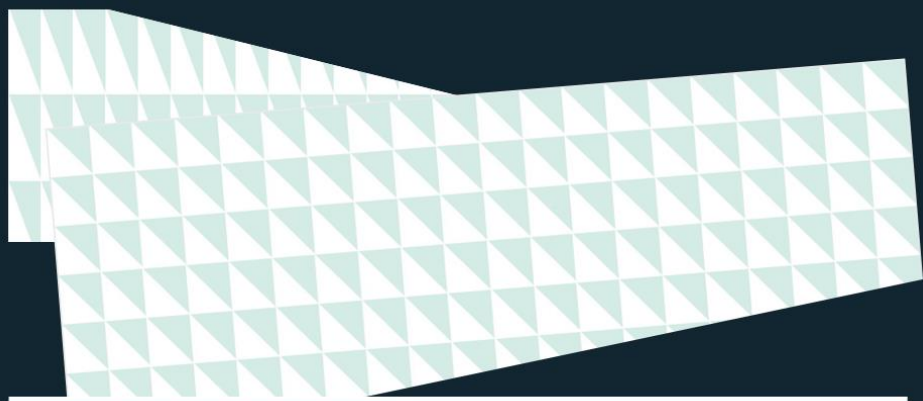


# An in-house solution to cash flow at risk

*Vincent Delort*

*October 4<sup>th</sup>, 2017*

*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.



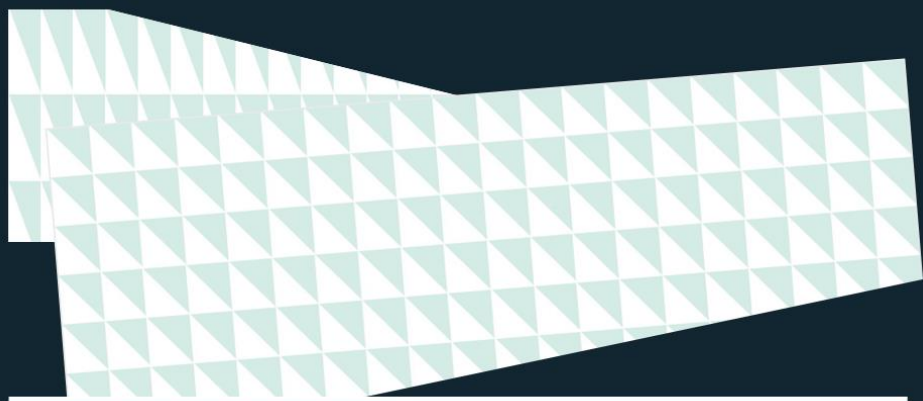


# An in-house solution to cash flow at risk

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A pair of light-colored sneakers with laces is shown from a top-down perspective. In the foreground, a banana peel is broken and scattered on a dark 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**.

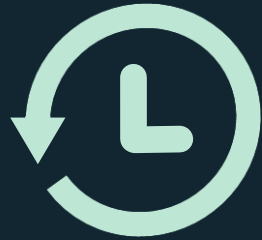
# Basic example

## Statement



# How to calculate CFaR?

*Common methods*



Historical Method

---



Parametric Method

---



Monte Carlo Method

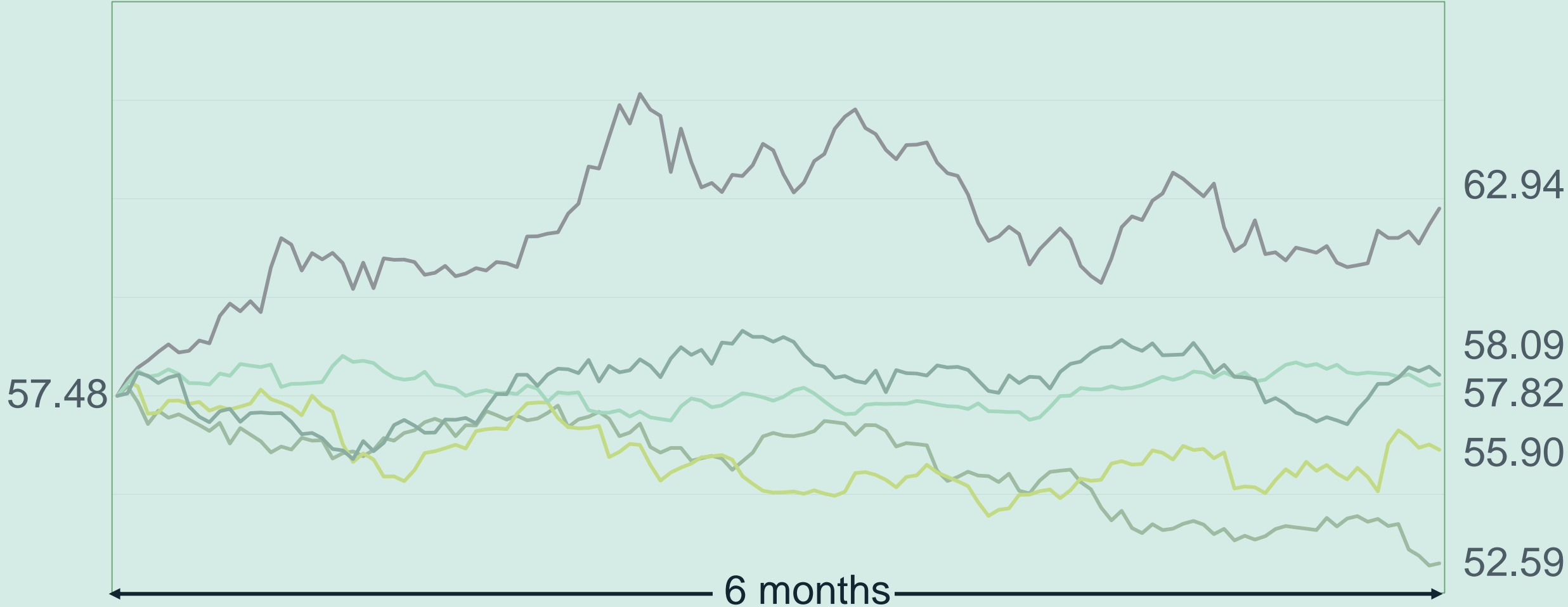
A photograph of ancient Greek temple ruins, featuring several tall, fluted columns and a partially collapsed pediment. The scene is set against a cloudy sky. A semi-transparent dark blue rectangular box is overlaid on the center of the image, containing white text.

Historical method:

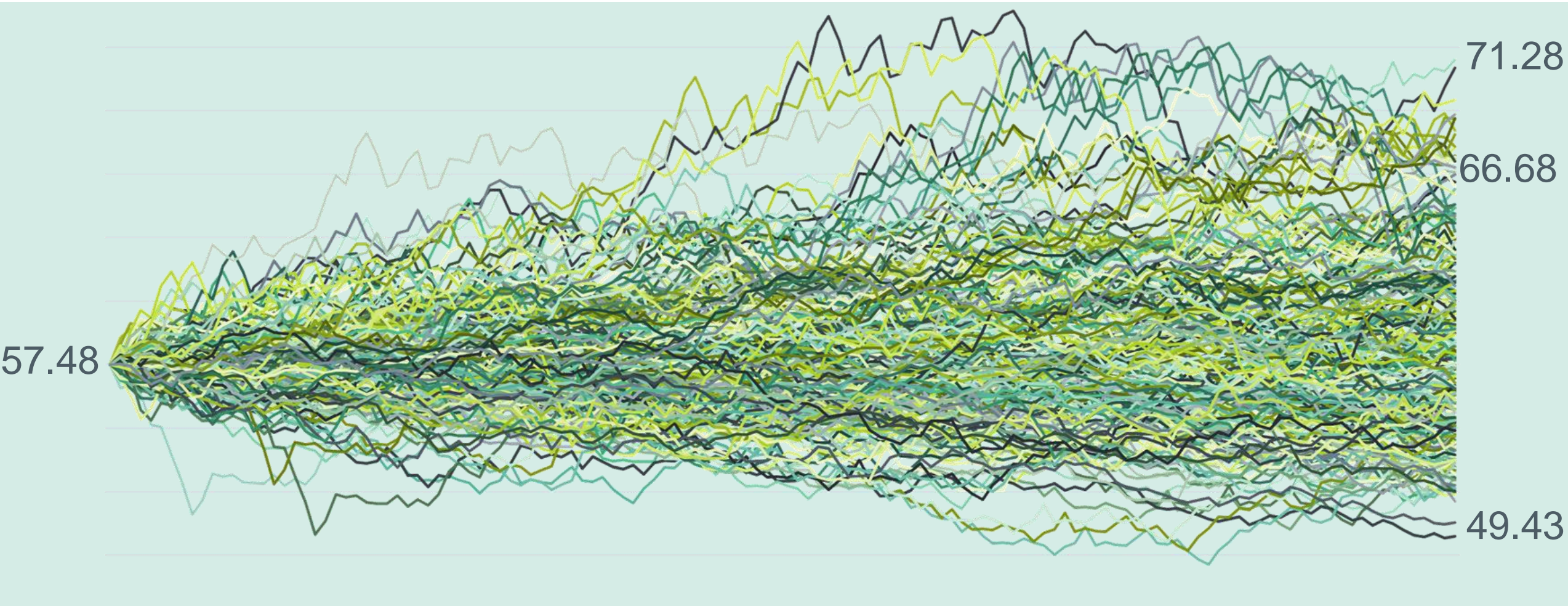
Look at the past to forecast the future.

# Historical method

*Observed past returns*



# Historical method

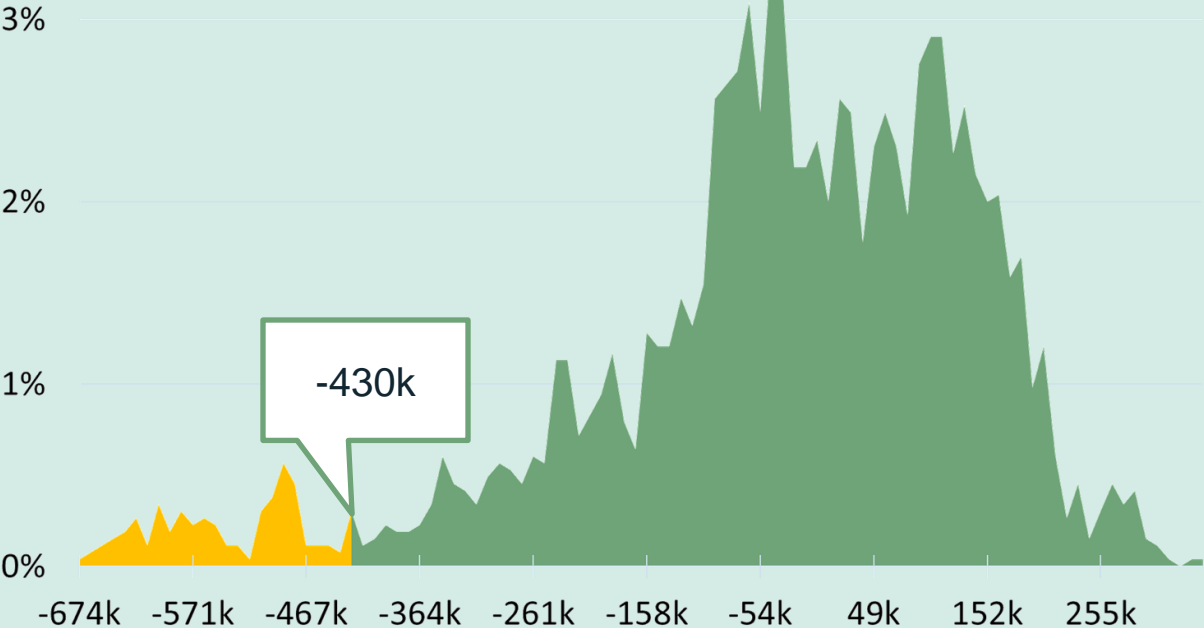




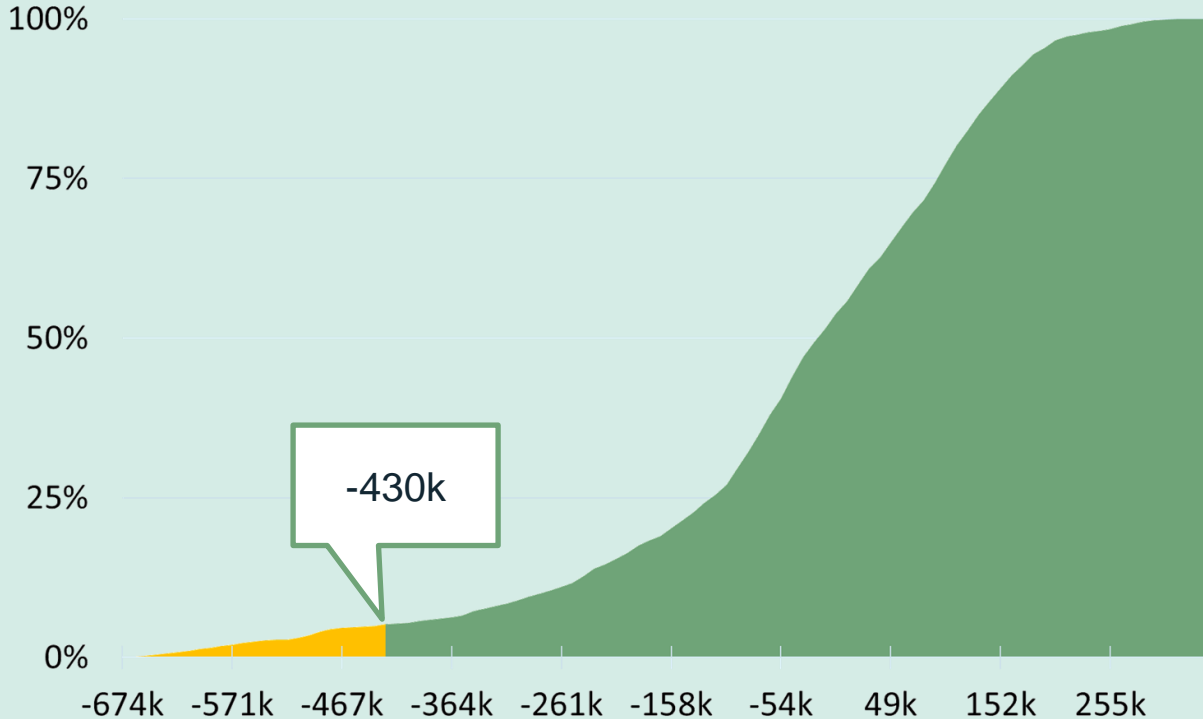
# Historical method - results

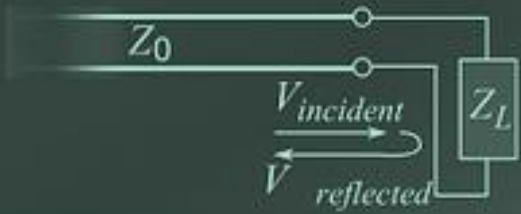
*10 years of history*

### Distribution of returns of Portfolio



### Cumulative Distribution of returns of Portfolio

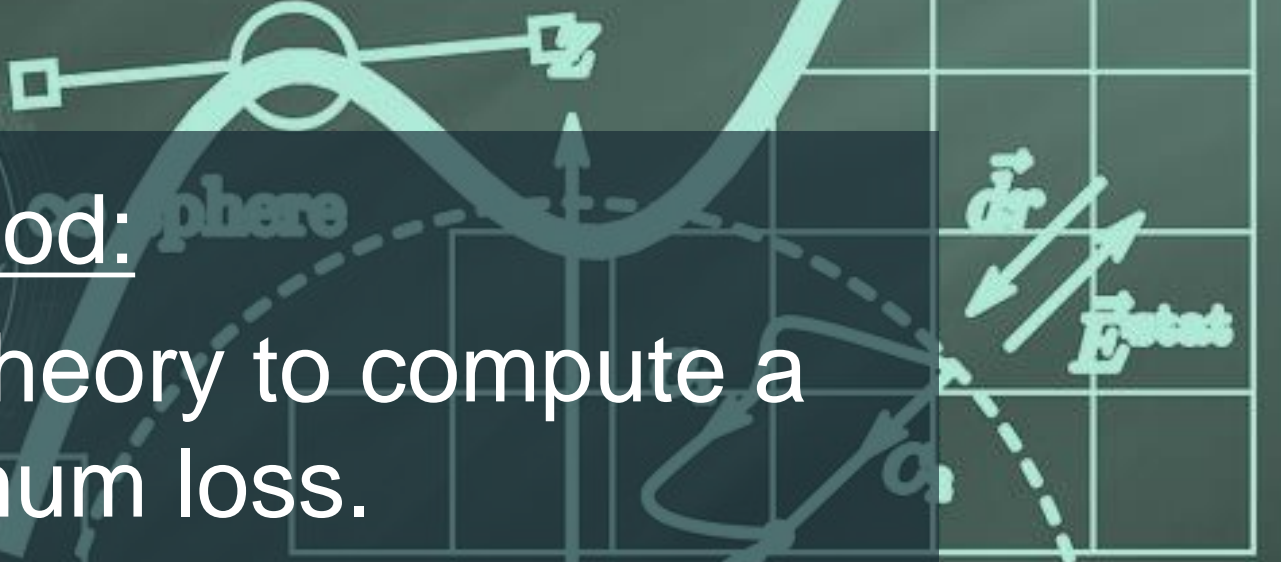
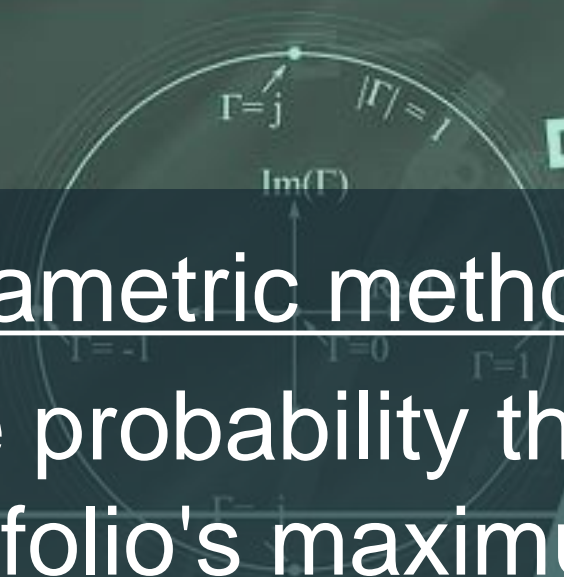




$$z = \frac{Z_L}{Z_0}$$

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

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



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

$$a \times b$$

$$W$$

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

b

$$|a \times b|$$

$\theta$

x

1

1

$$\sqrt{1^2 + 1^2}$$

1

1

1

1

# Parametric method

## *Formula and concept*

Assume the currency pairs returns follow a normal distribution.

The diagram shows the formula  $CFaR = (\mu - z_{\alpha} \times \sigma) \times P$  with four callout boxes. A large box at the top left points to  $z_{\alpha}$  and contains the text "the left tail  $\alpha$ -percentile of a standard normal distribution". A box labeled "Volatility" points to  $\sigma$ . A box labeled "Drift" points to  $\mu$ . A box labeled "Portfolio value" points to  $P$ .

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

the left tail  $\alpha$ -percentile of a standard normal distribution

Volatility

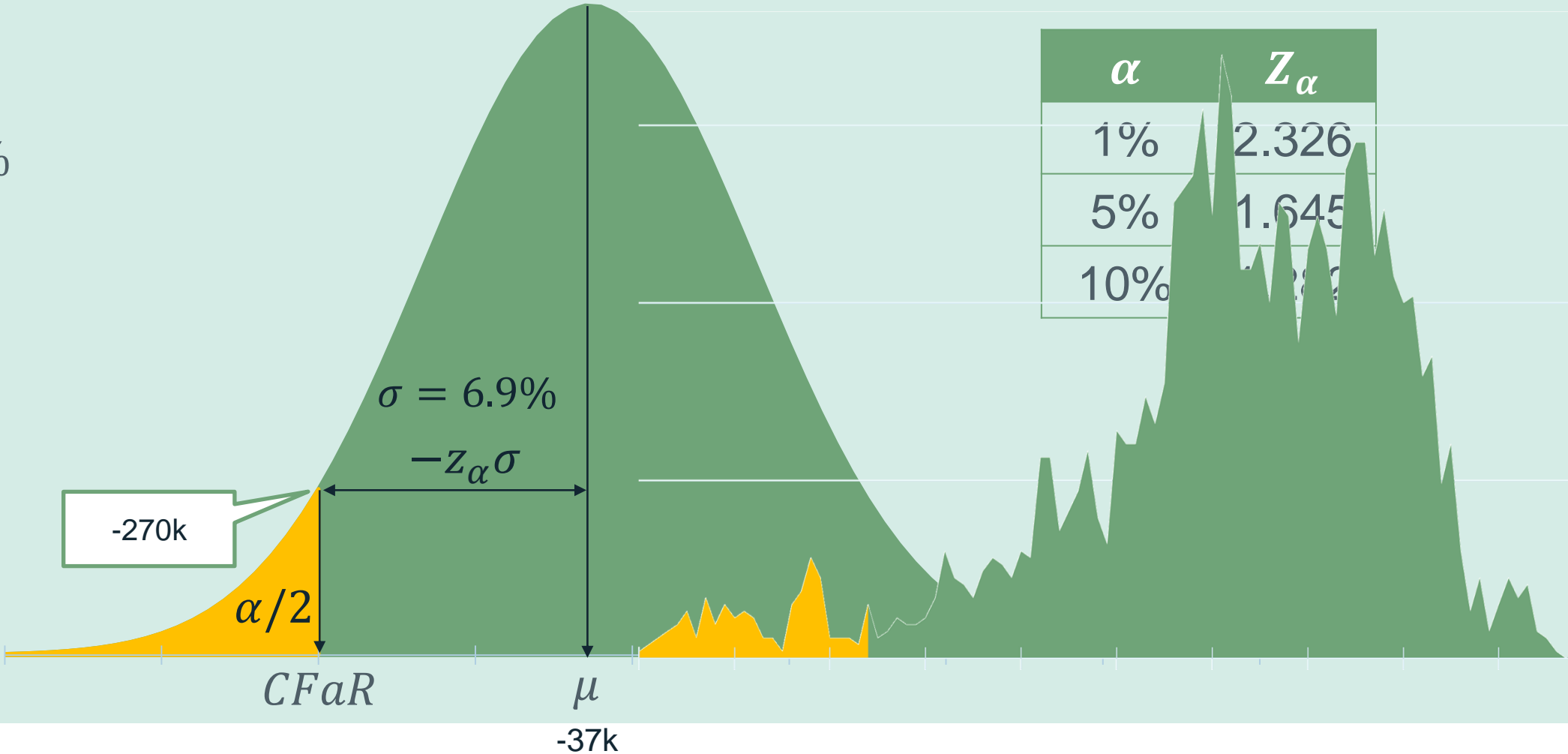
Drift

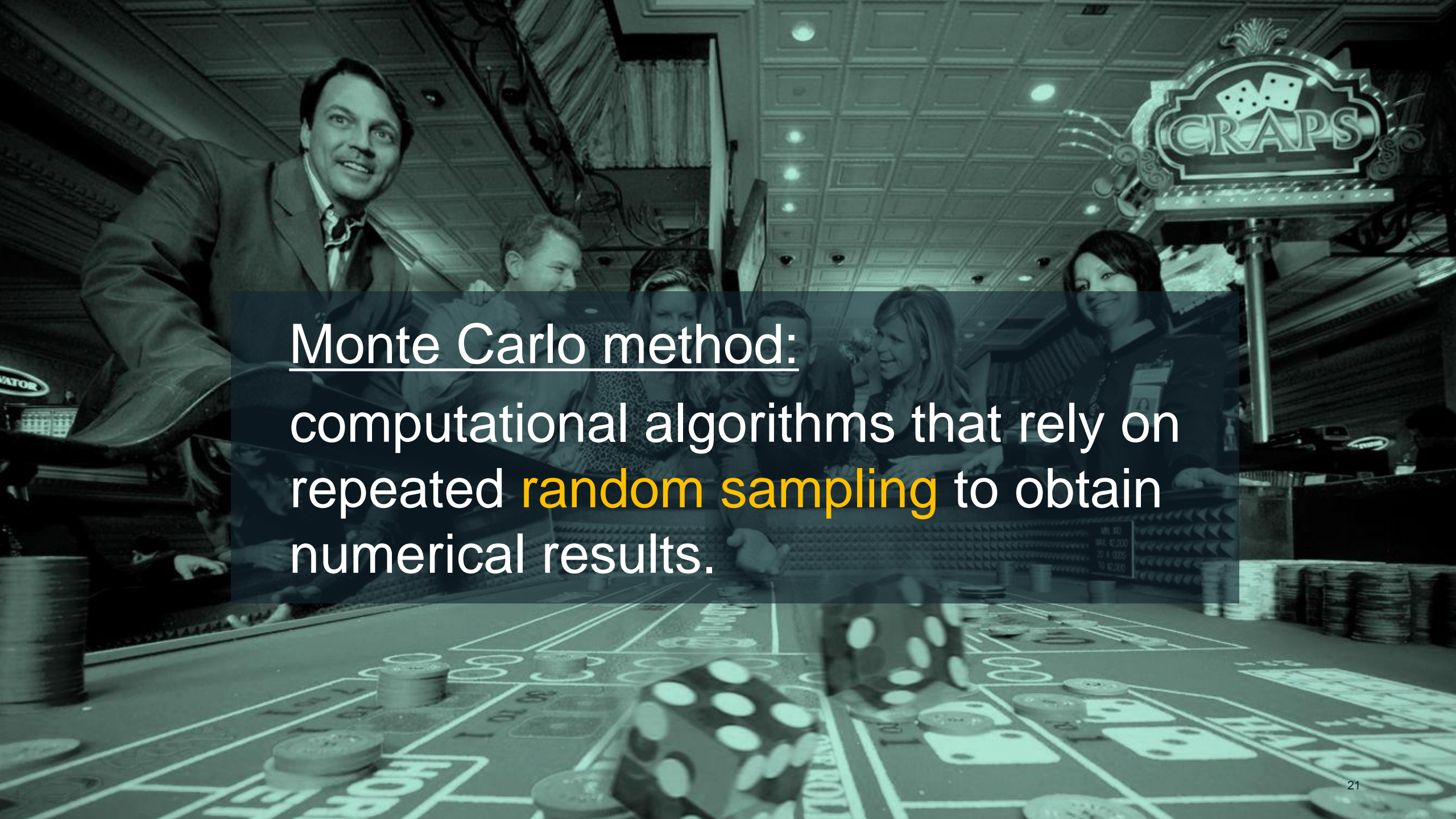
Portfolio value

# 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.

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

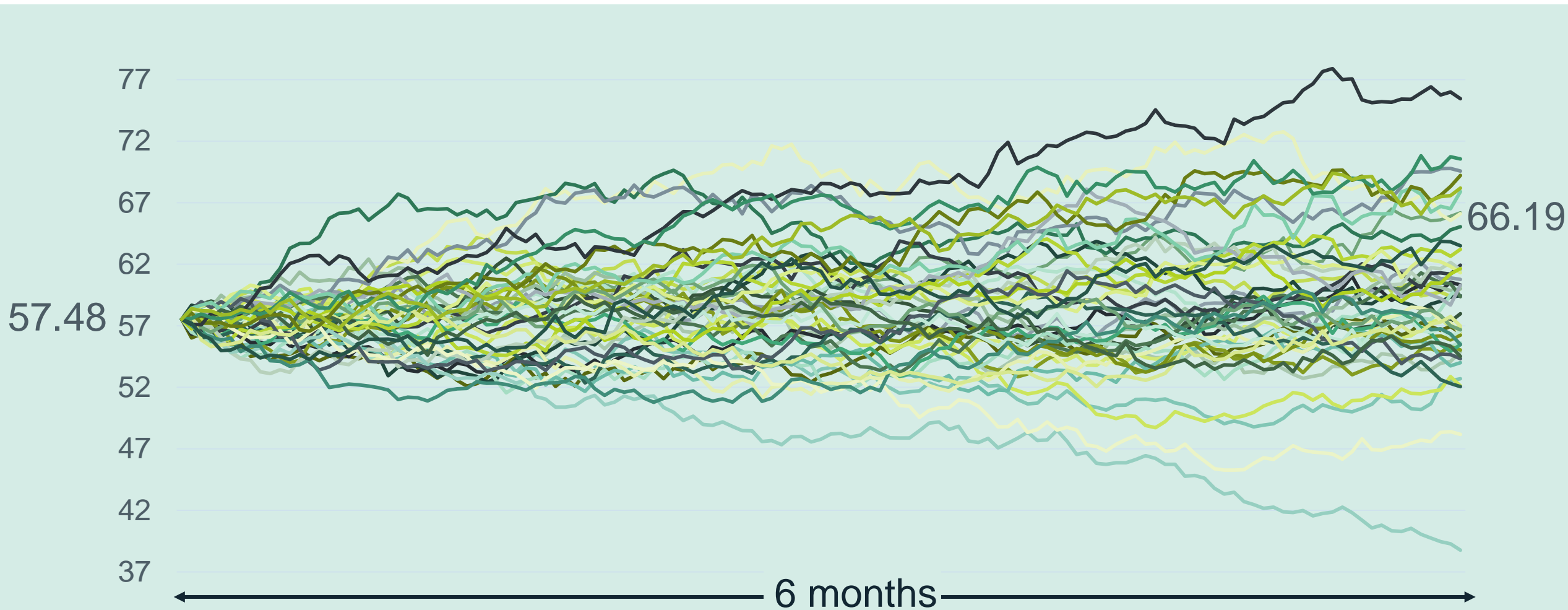
*Simulated spot*      *Spot*      *Expected return*      *Volatility*      *Random element*

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

*Drift*      *Volatility*

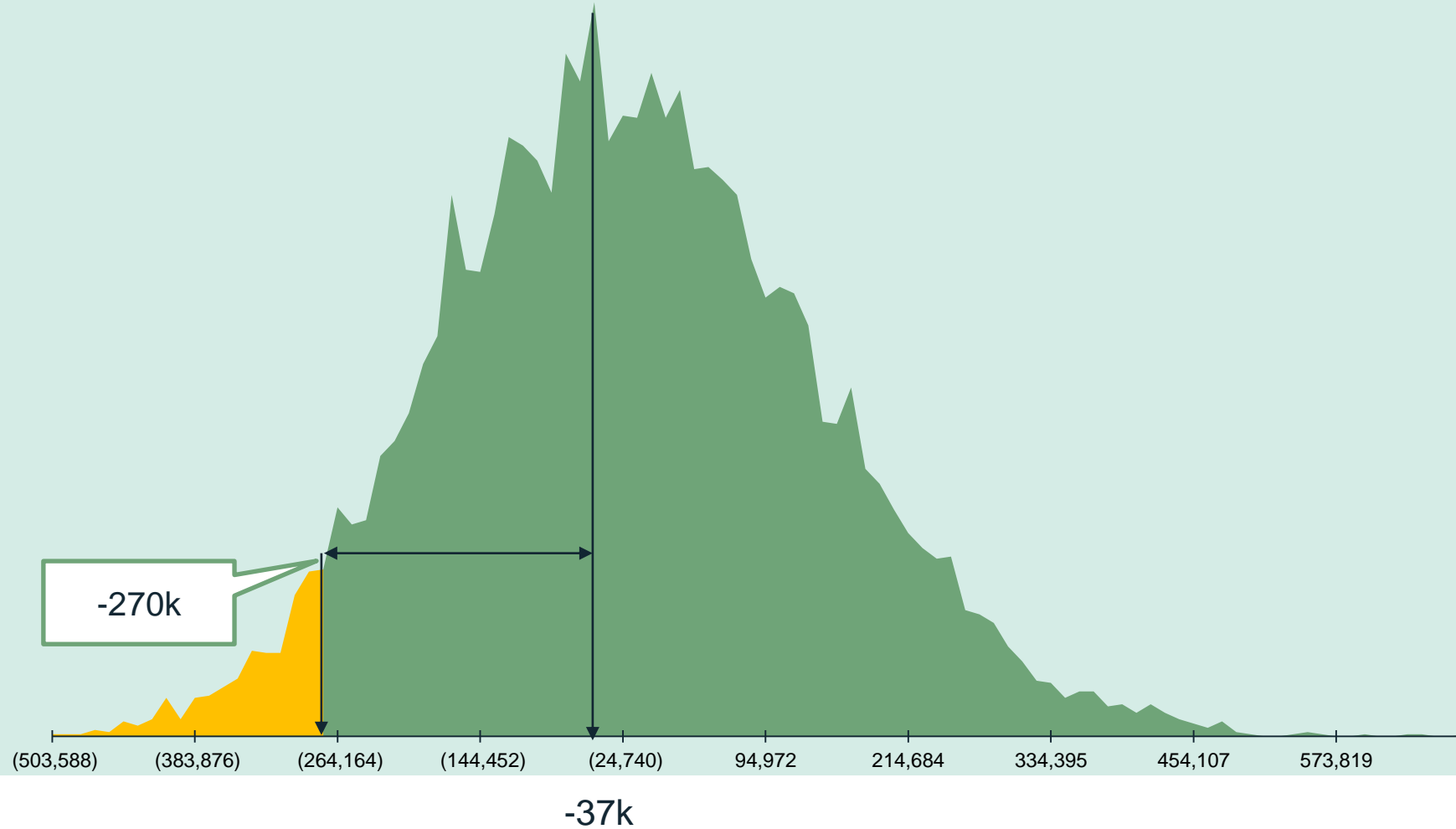
# Monte Carlo method

*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

The background of the slide is a dense, repeating pattern of overlapping squares. Each square is divided into a 4x4 grid. Some squares are dark grey with a white 'X' in the center, while others are light grey with a white grid pattern. The squares are arranged in a way that they appear to be scattered and overlapping, creating a textured, mosaic-like effect.

# 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-\$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  $\alpha_i = \text{NORMINV}(\text{RAND}(), 0, 1)$*

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



Enterprising  
Open  
Challenging