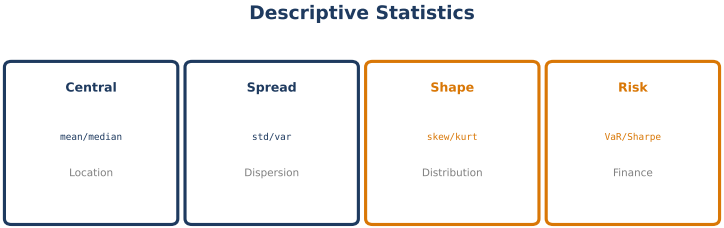
Lesson 13 Summary: Descriptive Statistics

Data Science with Python – Key Concepts

Data Science Program

Descriptive Statistics Overview



Descriptive statistics summarize and describe data

Measures of Central Tendency

Where is the center of the data?

- **Mean:** Average of all values (sensitive to outliers)
- **Median:** Middle value when sorted (robust to outliers)
- **Mode:** Most frequent value

Python:

```
df['Return'].mean()
df['Return'].median()
```

For skewed data, median is often more representative

Measures of Dispersion

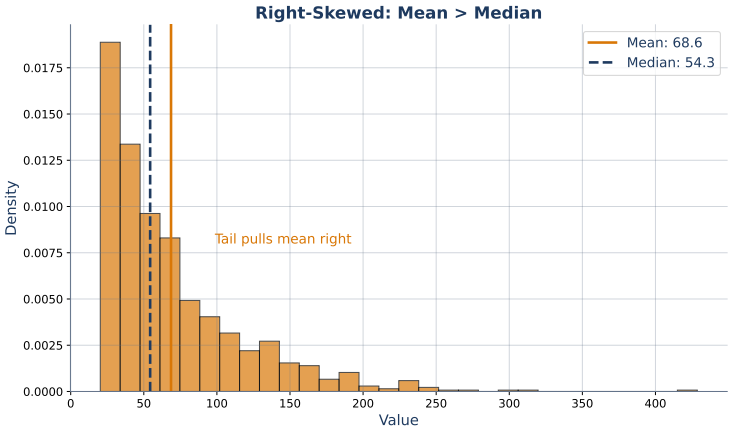
How spread out is the data?

- **Standard Deviation:** Average distance from mean
- **Variance:** σ^2 – squared std
- **Range:** Max - Min
- **IQR:** Q3 - Q1 (interquartile range)

Finance: Volatility $=$ std(returns) $\times\sqrt{252}$

Standard deviation is the most common risk measure

Skewness



Positive skew = long right tail; negative = long left tail

Kurtosis

Tail heaviness of the distribution:

- **Mesokurtic:** Normal distribution (kurtosis = 3)
- **Leptokurtic:** Fat tails, peaked (kurtosis ¿ 3)
- **Platykurtic:** Thin tails, flat (kurtosis ¡ 3)

Finance implication:
Fat tails = more extreme events than normal distribution predicts

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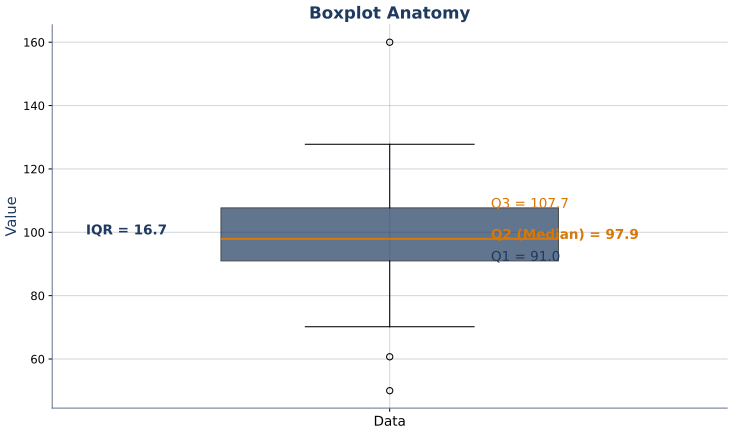
Excess kurtosis = kurtosis - 3

Boxplots



Boxplots show median, quartiles, and outliers

Risk Metrics

Key financial risk measures:

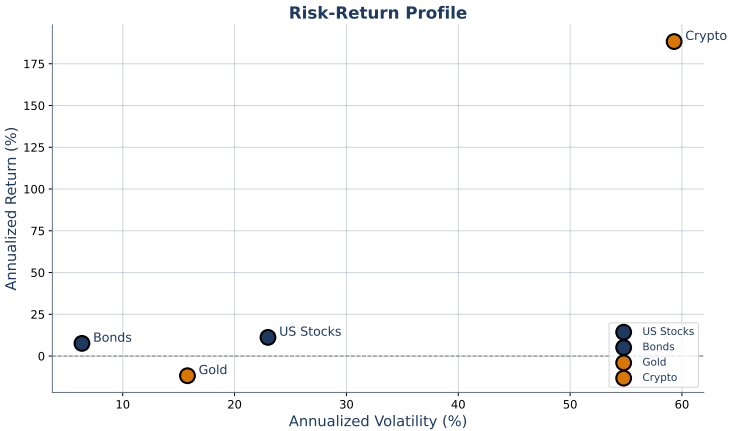
- **Sharpe Ratio:** (Return - Rf) / Volatility
- **VaR:** Maximum loss at confidence level
- **CVaR:** Expected loss beyond VaR
- **Max Drawdown:** Largest peak-to-trough decline

Example:

```
sharpe = returns.mean() / returns.std() * np.sqrt(252)
```

Risk-adjusted returns matter more than raw returns

Risk-Return Scatter



Plot return vs volatility to compare investments

Quick Reference

Essential Statistics Operations:

Statistic	Syntax
Mean	`df['col'].mean()`
Median	`df['col'].median()`
Std deviation	`df['col'].std()`
Skewness	`df['col'].skew()`
Kurtosis	`df['col'].kurtosis()`
Percentile	`df['col'].quantile(0.95)`
Summary	`df['col'].describe()`

Always explore data with descriptive statistics first