Lesson 12: Time Series Basics

Data Science with Python – BSc Course

45 Minutes

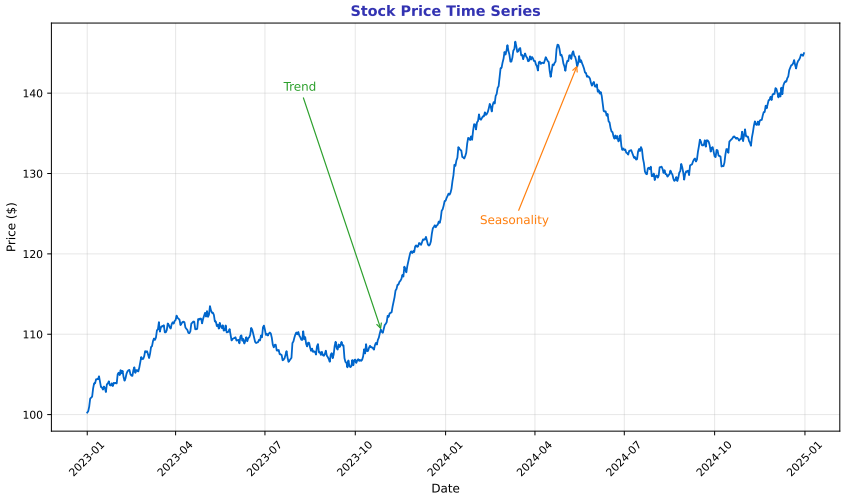
Learning Objectives

After this lesson, you will be able to:

- DateTime index
- Resampling (daily to monthly)
- Rolling windows
- shift() and pct_change()
- Time series patterns in finance

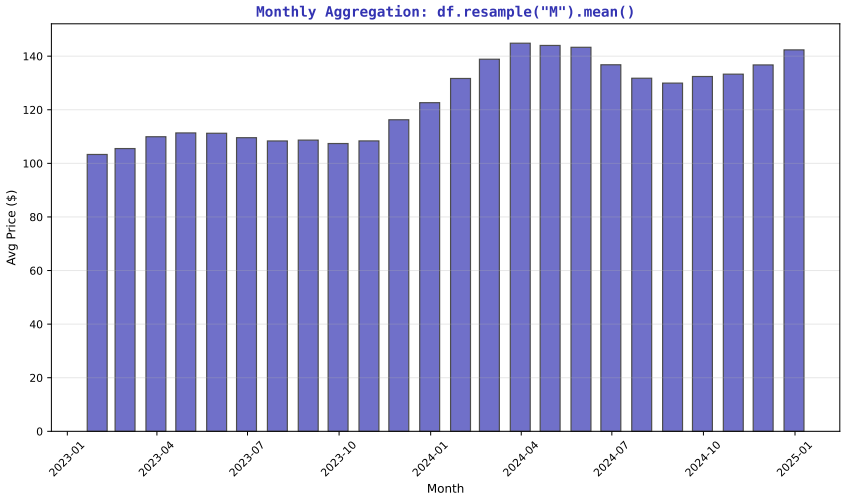
Finance application: Stock data processing and analysis

Basic Time Series



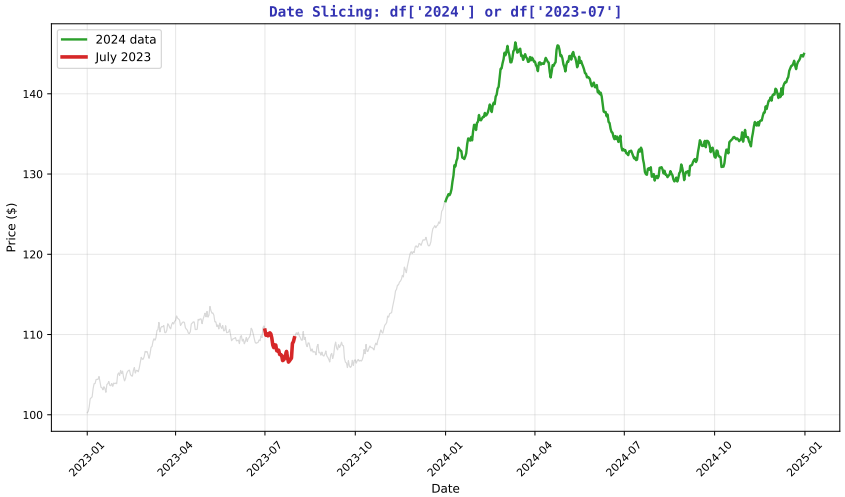
Plotting time-indexed data

Monthly Aggregation



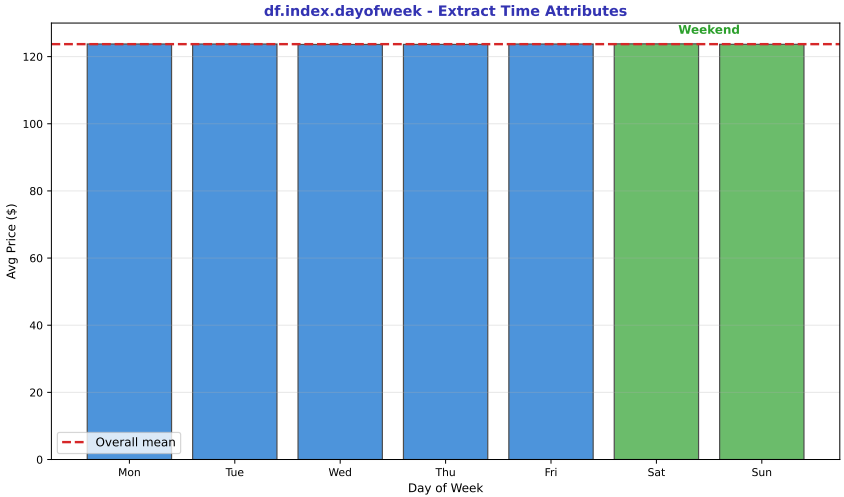
Summarizing daily data into monthly periods

Date Slicing



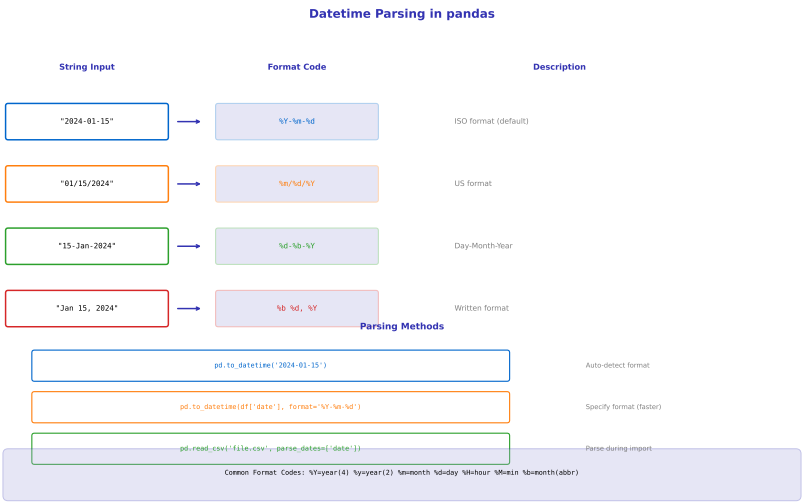
Selecting data by date range

Day of Week Patterns



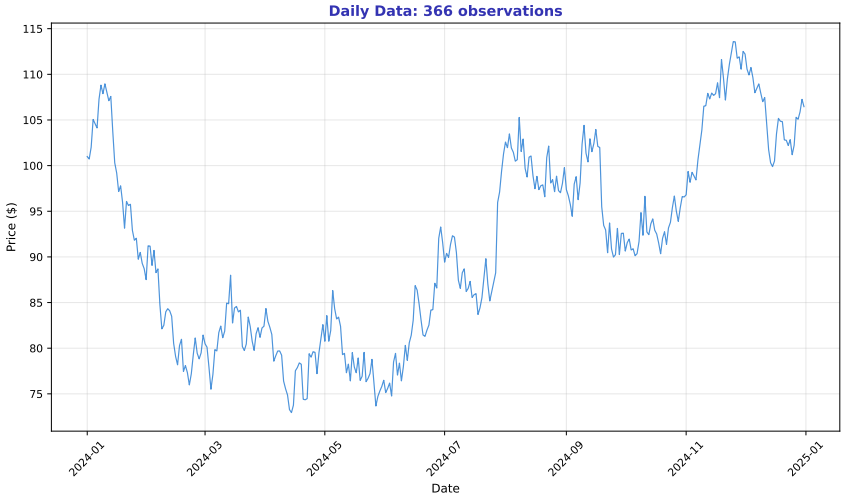
Analyzing weekday effects

Datetime Parsing



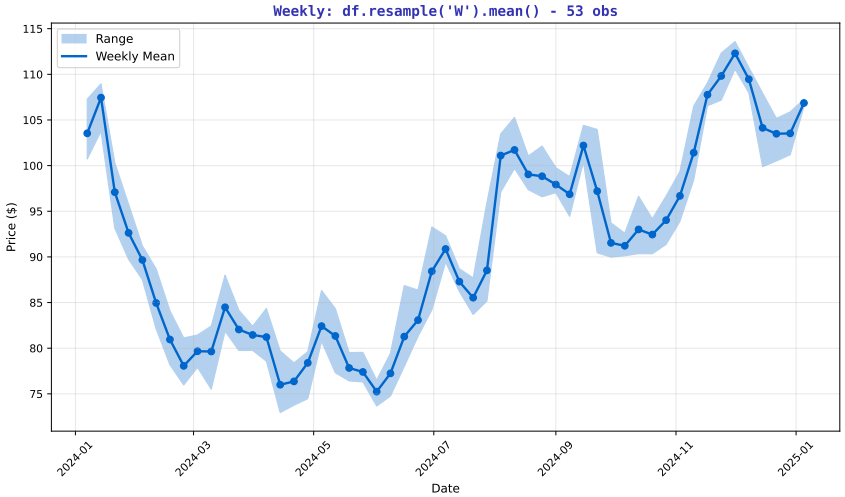
Converting strings to datetime objects

Daily Data



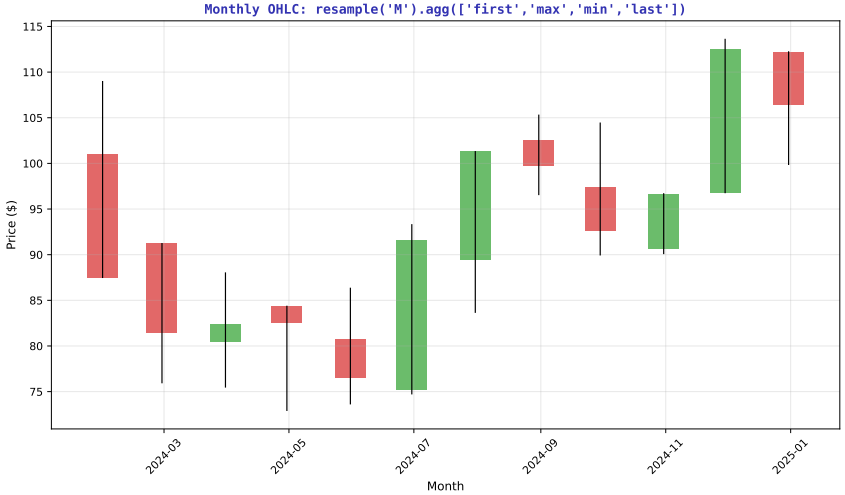
Working with daily frequency

Weekly Resampling



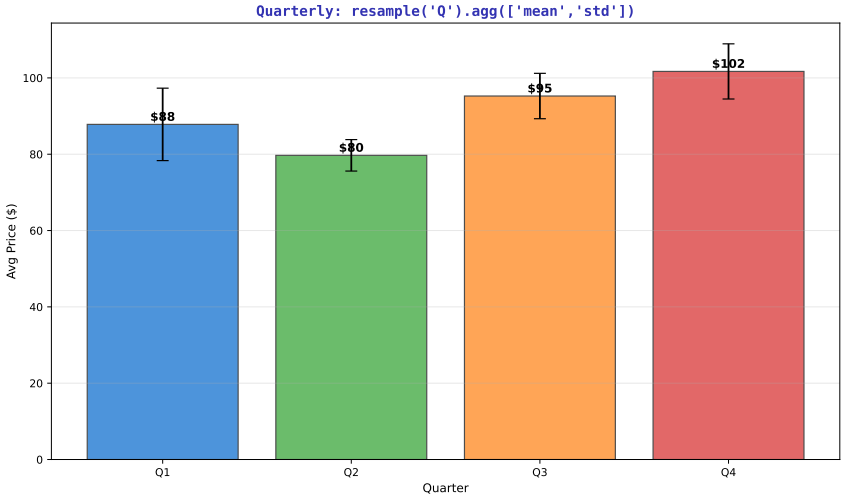
Aggregating to weekly frequency

Monthly OHLC



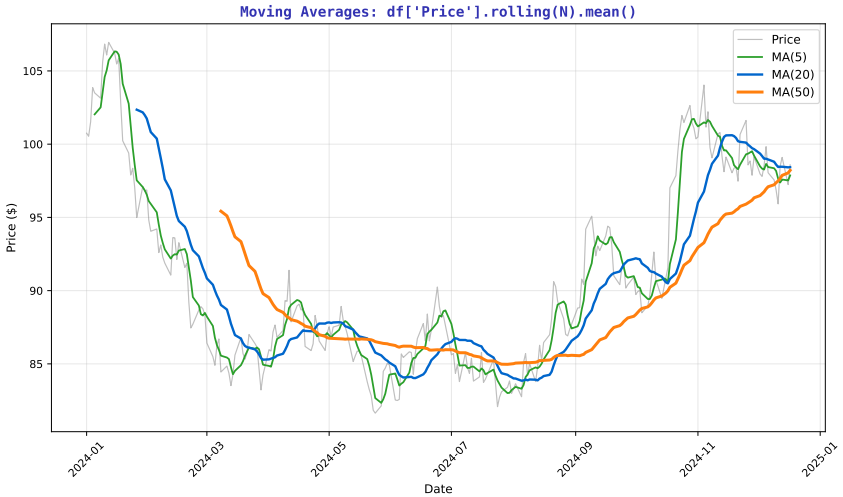
Open-High-Low-Close monthly bars

Quarterly Resampling



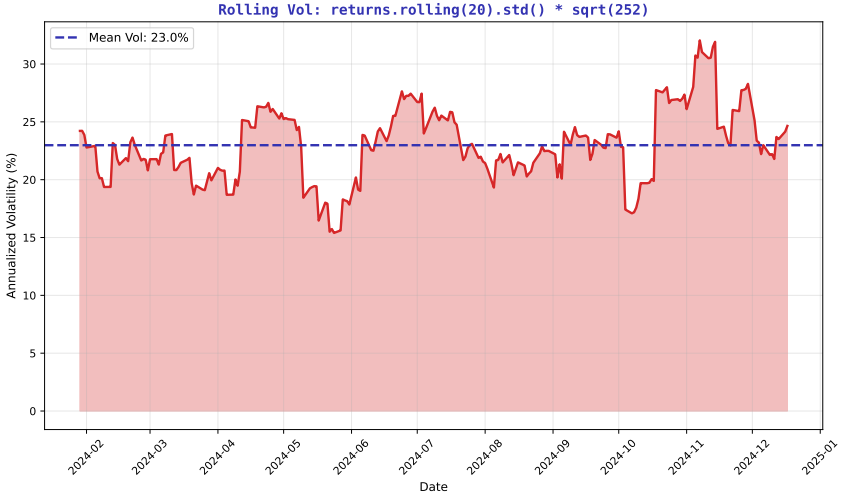
Aggregating to quarterly frequency

Moving Averages



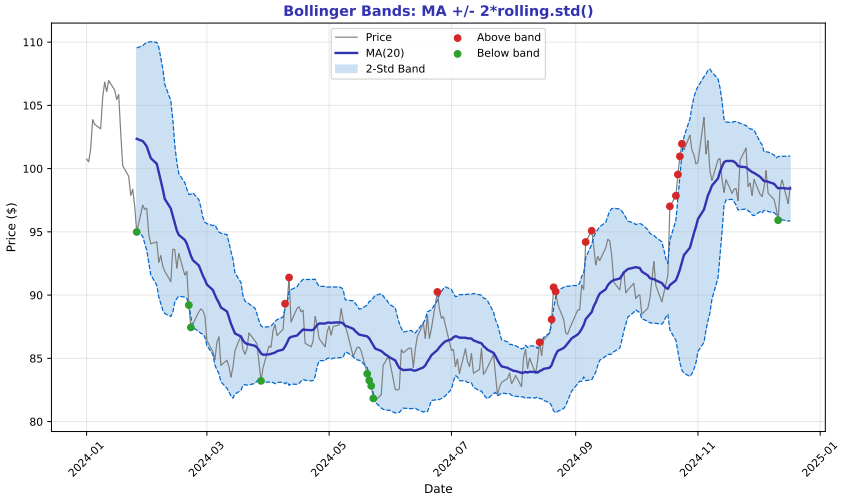
Smoothing with rolling mean

Rolling Volatility



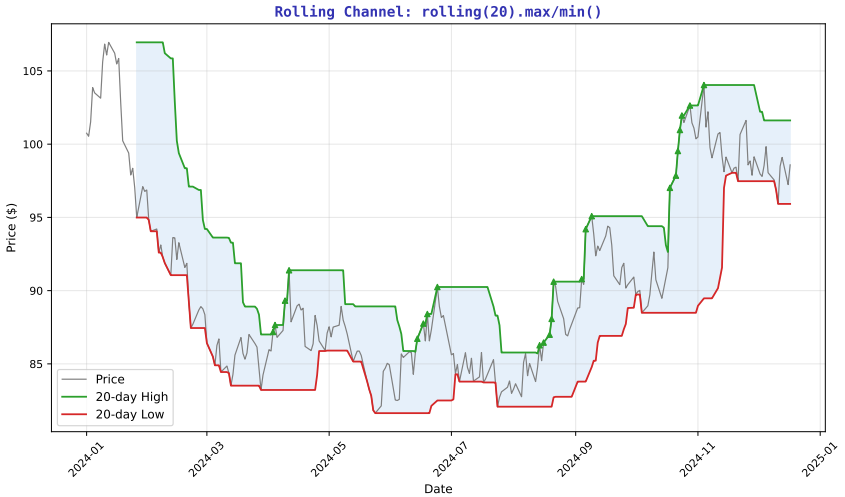
Measuring time-varying risk

Bollinger Bands



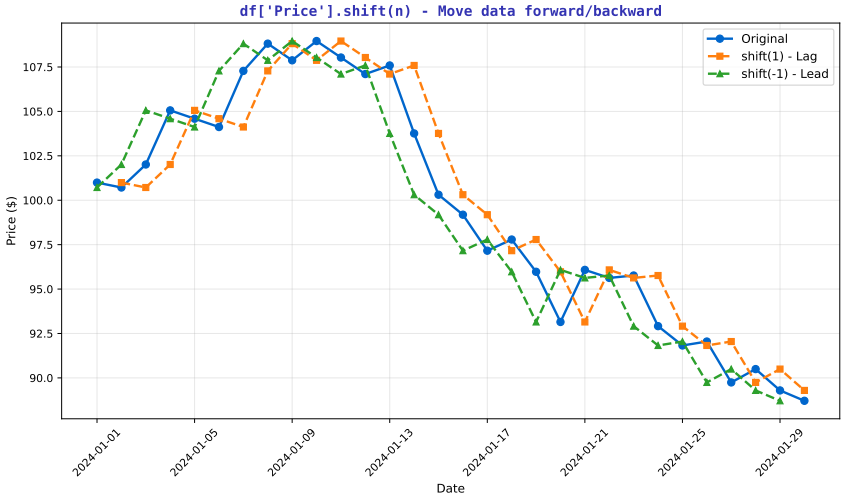
Trading bands using rolling statistics

Rolling Channel



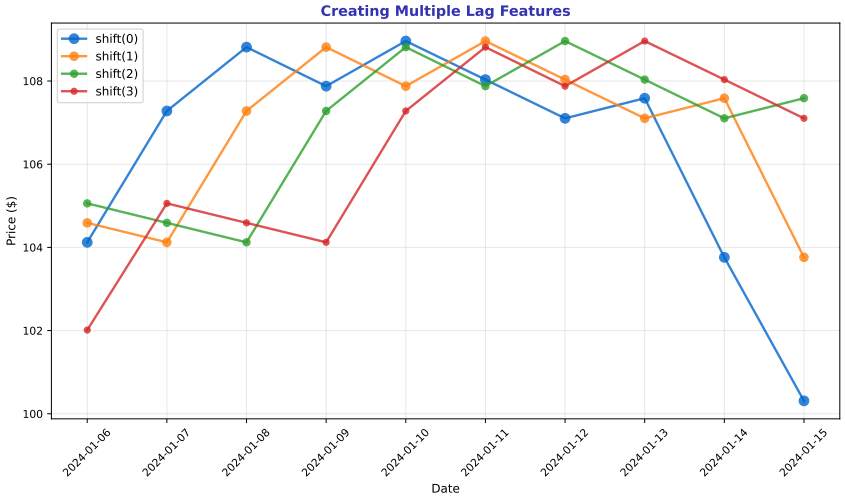
Price channels with rolling min/max

Shift Demo



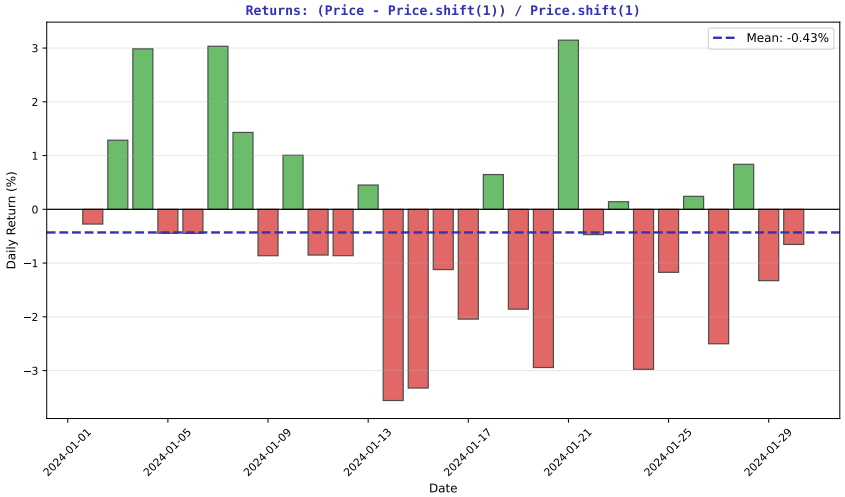
Basic lag operation

Multiple Lags



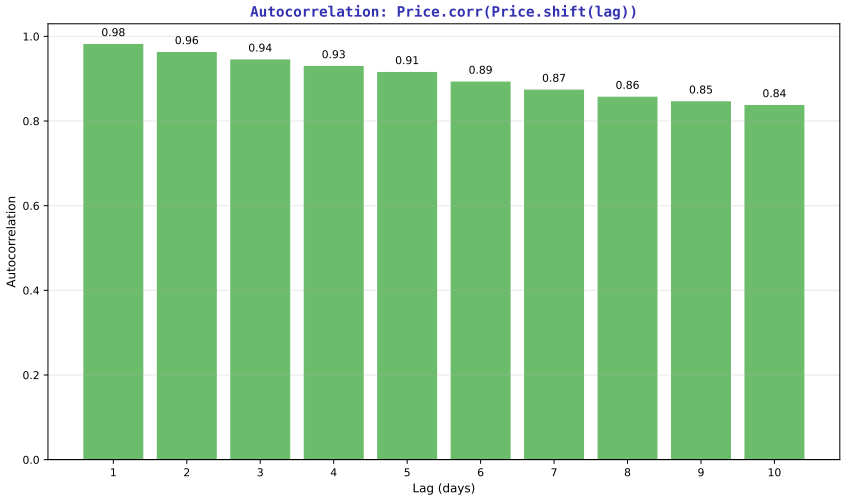
Creating multiple lagged features

Returns with Shift



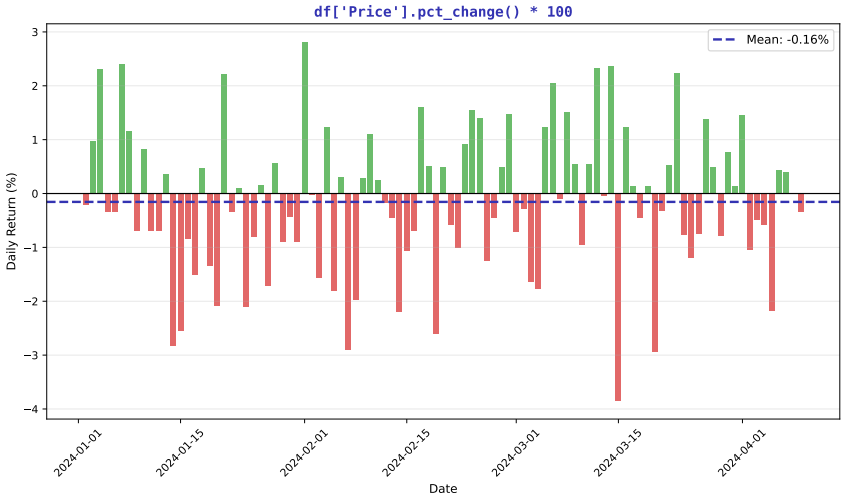
Computing returns using shift

Autocorrelation



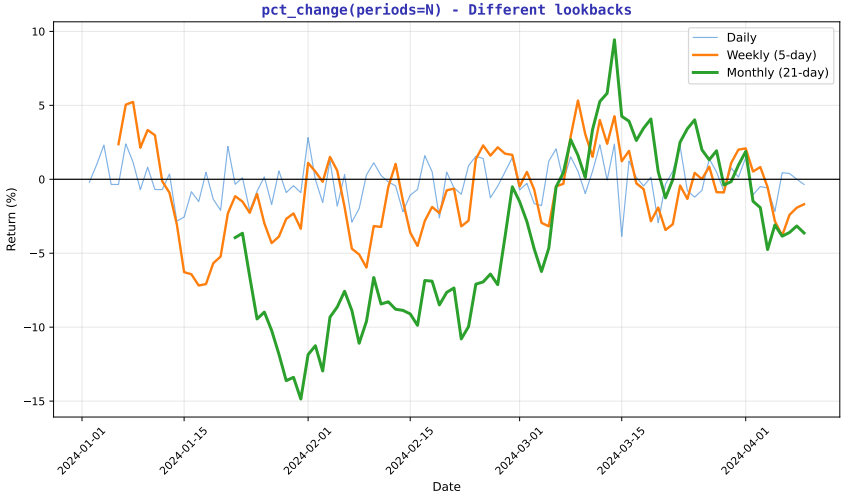
Serial correlation in returns

Daily Returns



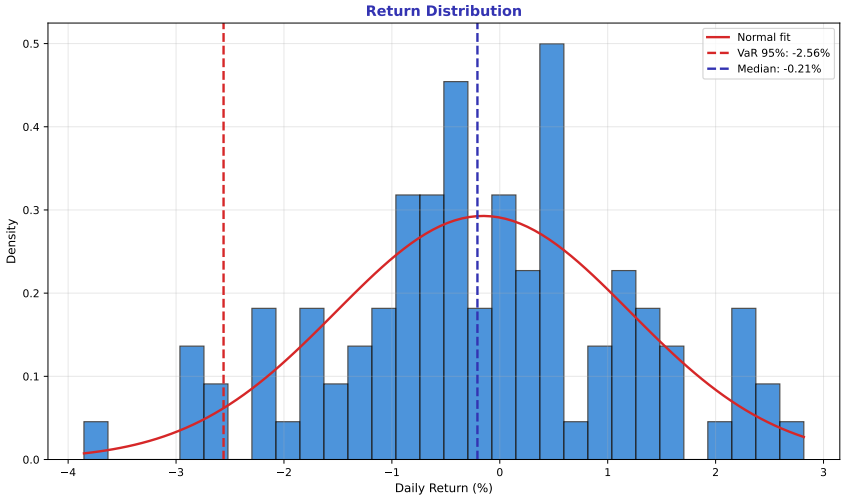
Computing percentage changes

Periods Comparison



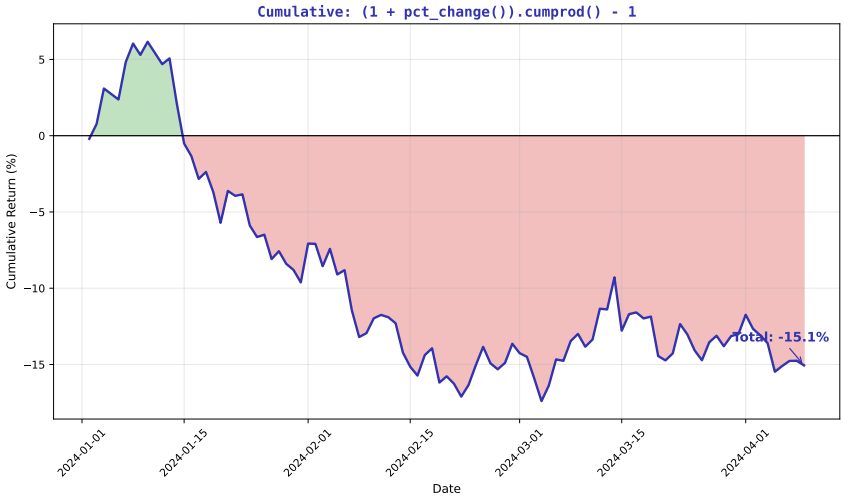
Different return periods

Return Distribution



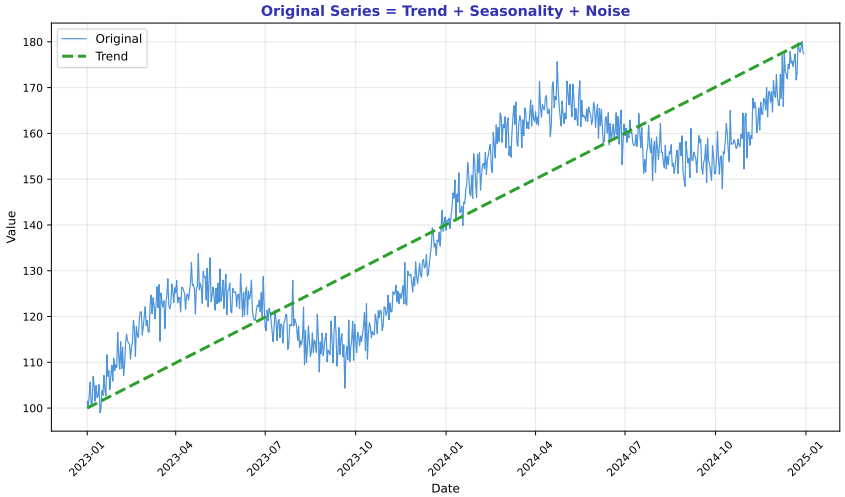
Statistical properties of returns

Cumulative Returns



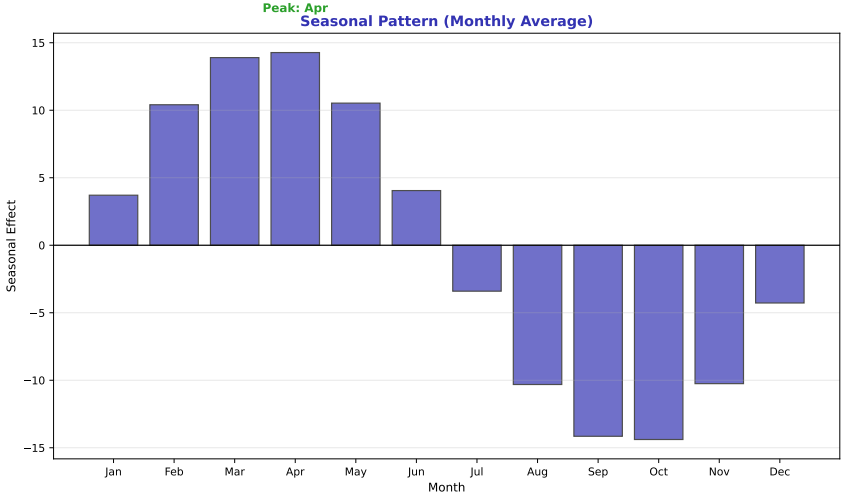
Growth of investment over time

Original Trend



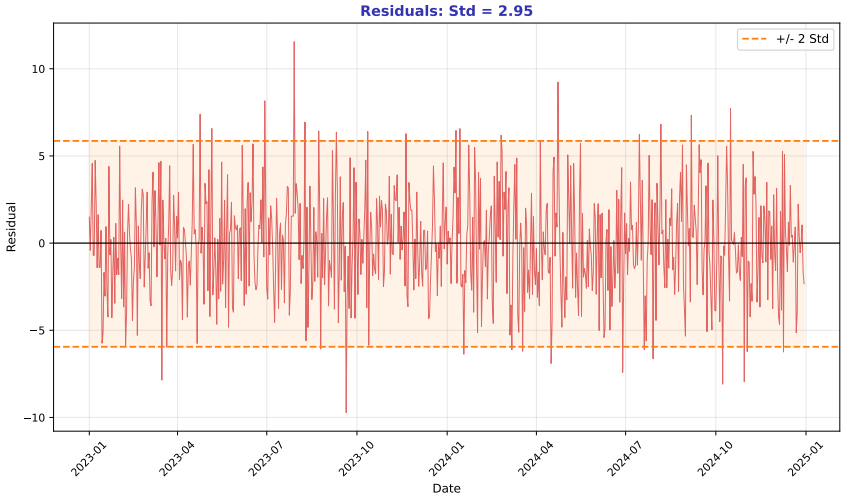
Identifying the long-term trend

Seasonal Pattern



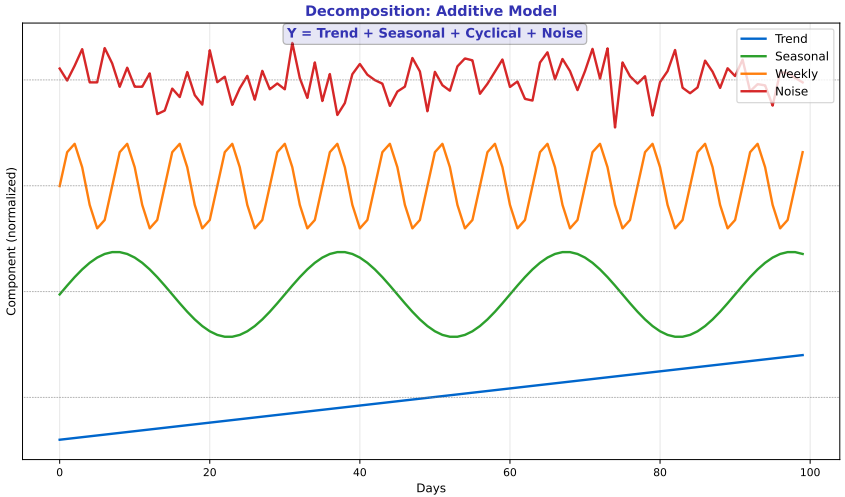
Recurring patterns within periods

Residuals



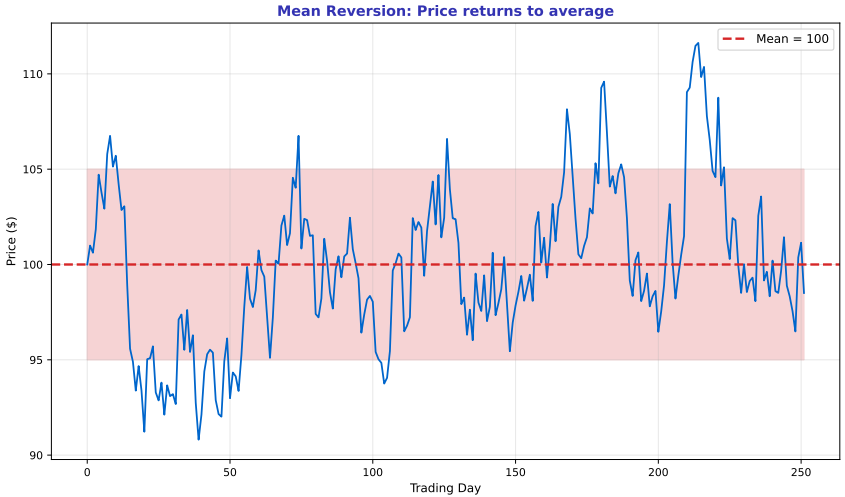
Random component after decomposition

Full Decomposition



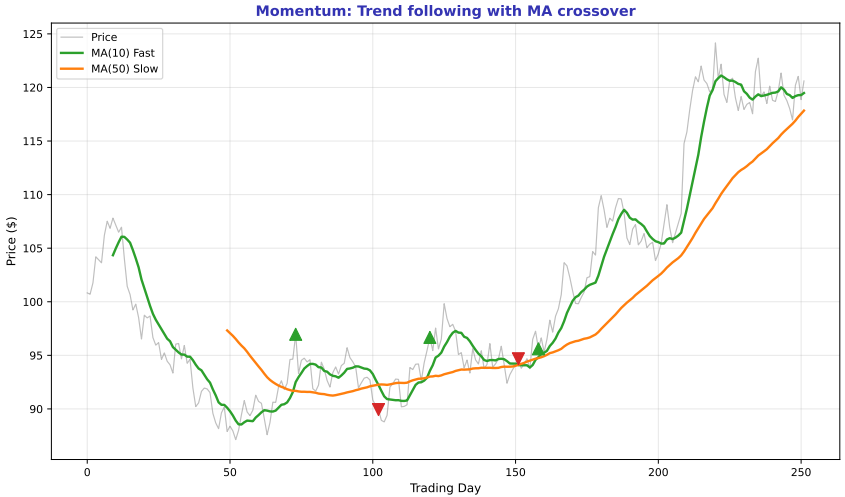
Trend + Seasonal + Residual

Mean Reversion



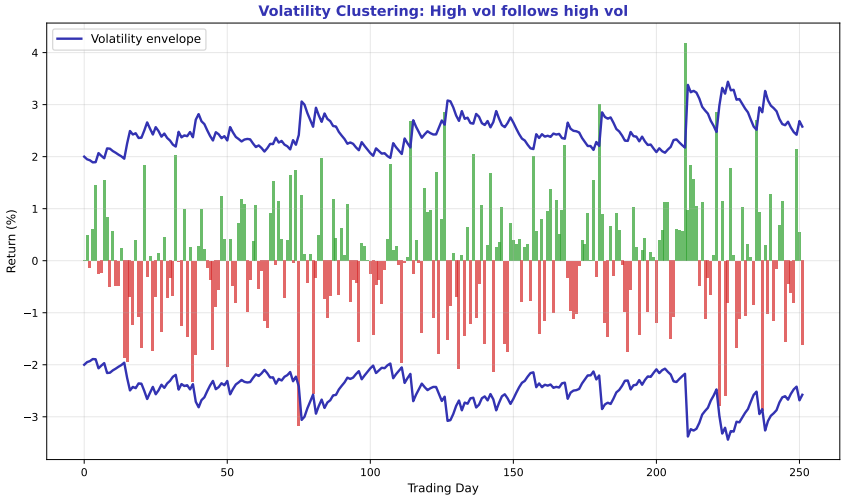
Price returning to average

Momentum



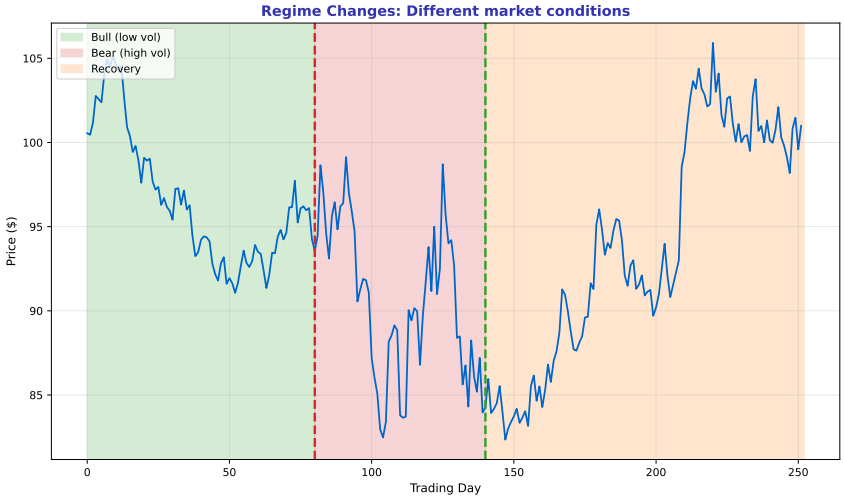
Trend-following patterns

Volatility Clustering



High volatility follows high volatility

Regime Changes



Different market conditions

Lesson Summary

Key Takeaways:

- DateTime index for time series data
- Resampling changes data frequency
- Rolling windows for moving statistics
- shift() creates lags, pct_change() computes returns
- Recognize patterns: trend, seasonality, mean reversion, momentum

Practice: Apply these concepts to the stock price dataset.