FIN4104/4911
Quantitative Analysis for Financial Decisions

Chapter 11: Technical Analysis
Financial Trading with Python

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Course Outline

- Financial trading
- Technical Indicators
- Trading Signals
- Evaluate Performance

The concept of financial trading

Financial trading is the buying and selling of financial assets

Various financial instruments to trade:

- Equities
- Bonds
- Forex
- Commodities
- Cryptocurrencies

Why people trade

To make a profit by taking calculated risks

- Long positions: profit from upward price movement
- Short positions: profit from downward price movement

Market participants:

- Institutional traders
- Retail traders

Trading vs. Investing

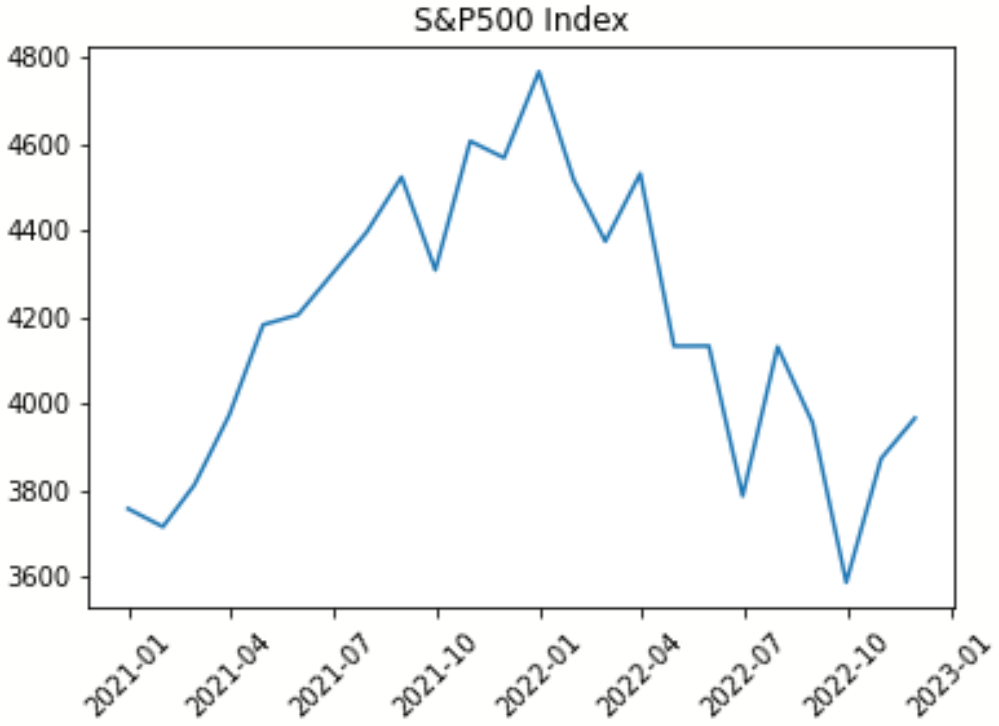
Trading:

- Shorter holding period
- Focus on short-term trends or price fluctuations
- Take both long and short positions

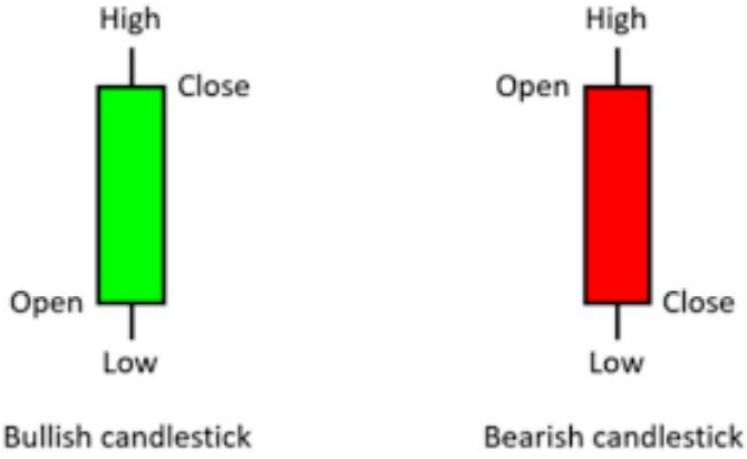
Investing:

- Longer holding period
- Focus on market fundamentals
- Take mostly long positions

Financial time series data



Candlestick Chart



- Each candlestick displays high, low, open, and close
- The color indicates bullish (rising prices) or bearish (falling prices) movement

Candlestick

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Types of traders

Different types of traders

- Day Trader: holds positions throughout the day but usually not overnight
- Swing Trader: holds positions from a few days to several weeks
- Position Trader: holds positions from a few months to several years

Technical Indicator

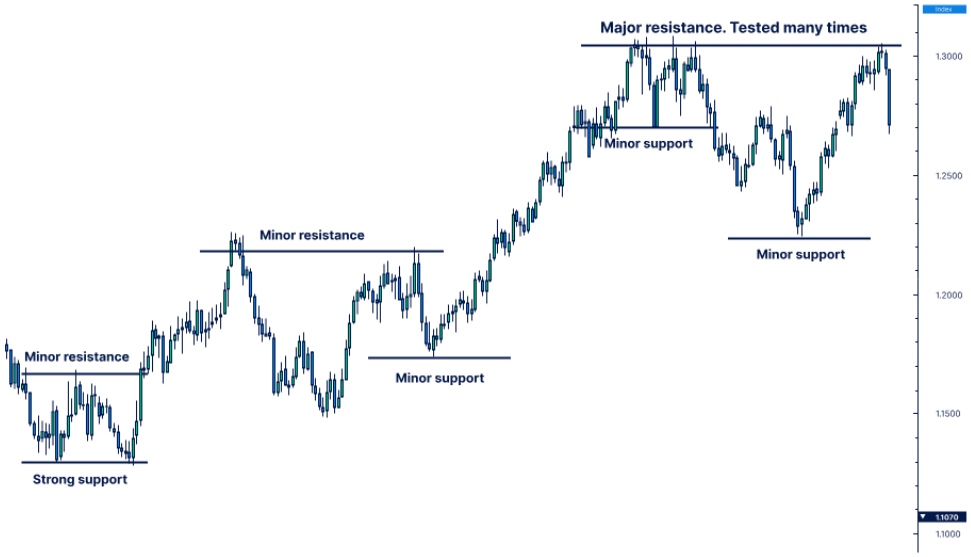
What are technical indicators?

- Mathematical calculations based on historical market data
- Assume the market is efficient and the price has incorporated all public information
- Help traders to gain insight into past price patterns

Type of Indicators

- **Trend indicators**: measure the direction or strength of a trend
  - Example: Moving averages (MA), Average Directional Movement Index (ADX)
- **Momentum indicators**: measure the velocity of price movement
  - Example: Relative Strength Index (RSI)
- **Volatility indicators**: measure the magnitude of price deviations
  - Example: Bollinger Bands

Support and Resistance Line



- Support and Resistance is one of the most used techniques in technical analysis based on a concept that's easy to understand but difficult to master.
- It identifies price levels where historically the price reacted either by reversing or at least by slowing down and prior price behavior at these levels can leave clues for future price behavior. There are many different ways to identify these levels and to apply them in trading.
- Support and Resistance levels can be identifiable turning points, areas of congestion or psychological levels (round numbers that traders attach significance to). The higher the timeframe, the more relevant the levels become.

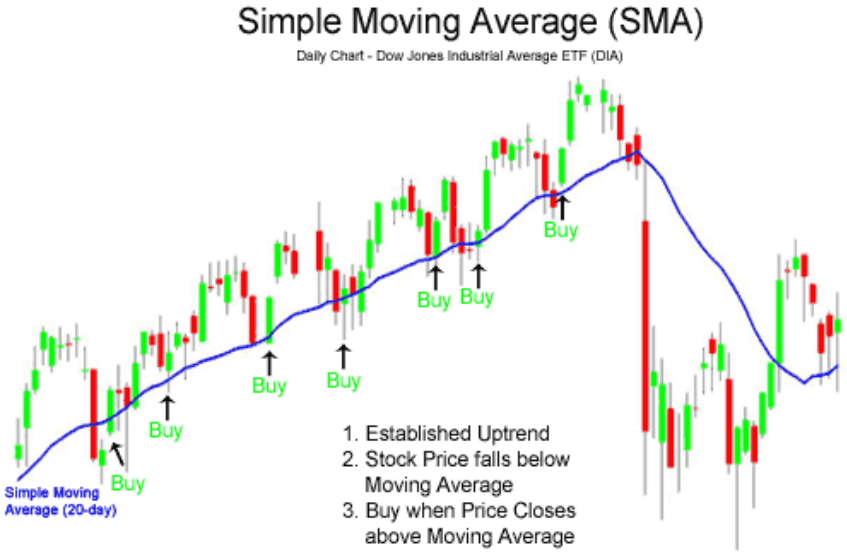
Moving Average Indicators

- SMA: Simple Moving average
- EMA: Exponential Moving Average

- Characteristics:
  - Move with the price
  - Smooth out the data to better indicate the price direction

SMA vs. EMA

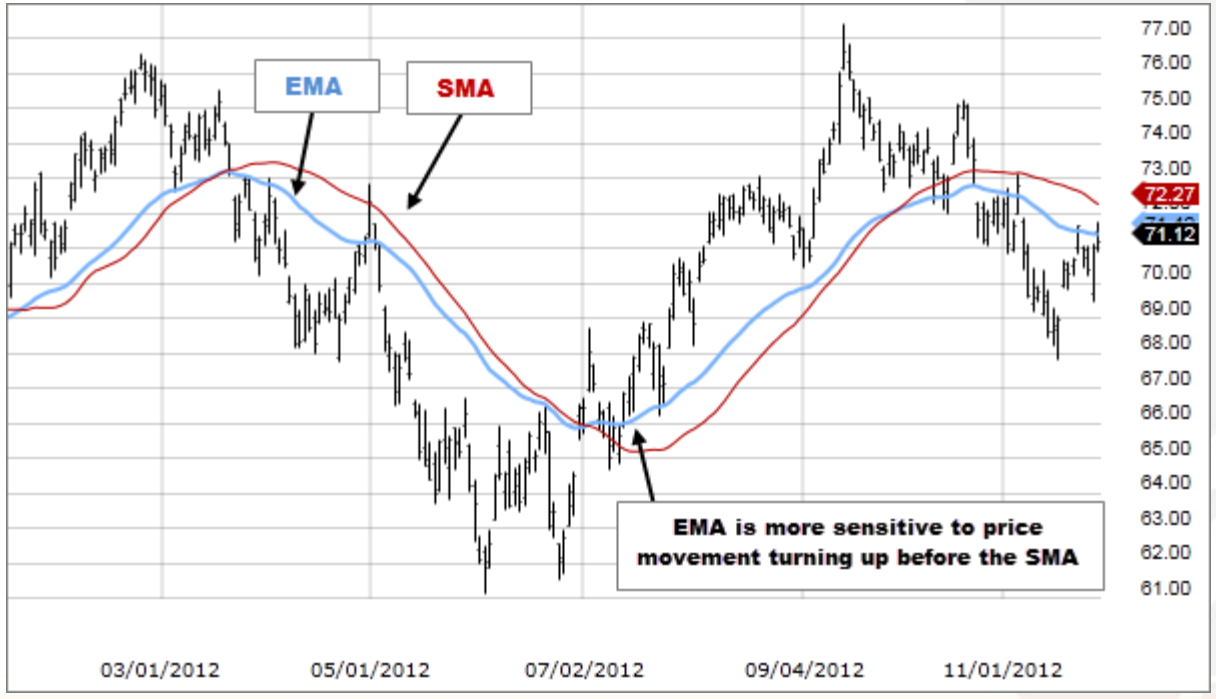
SMA



EMA

SMA vs. EMA

- EMA is more sensitive to most recent price movement



RSI

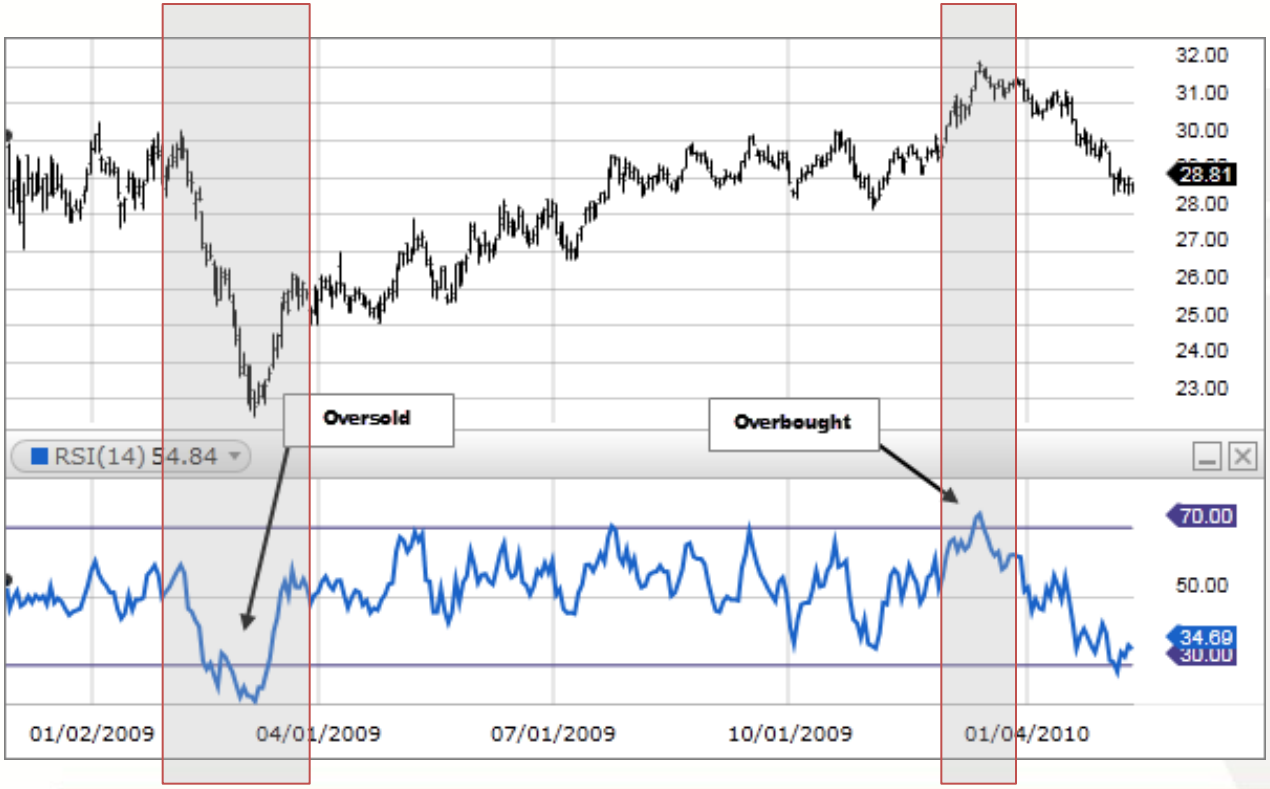
- Stands for "Relative Strength Index"
- Developed by J. Welles Wilder
  - "New Concepts in Technical Systems" (1987)
- Measures the momentum of a trend
  - Oscillates between 0 and 100
  - RSI > 70: Overbought
  - RSI < 30: Oversold

$$RSI = 100 - 100/(1 + RS)$$

Where:

- RS: relative strength
- RS = average of upward price changes / average of downward price changes

How is RSI calculated?



Bollinger Bands

- Developed by John Bollinger
  - "Bollinger on Bollinger Bands"

- Measure price volatility
- Composed of three lines:
  - Middle band: n-period simple moving average
  - Upper band: k-standard deviations above the middle band
  - Lower band: k-standard deviations below the middle band

Bollinger Bands Implication

- The wider the bands, the more volatile the asset prices.

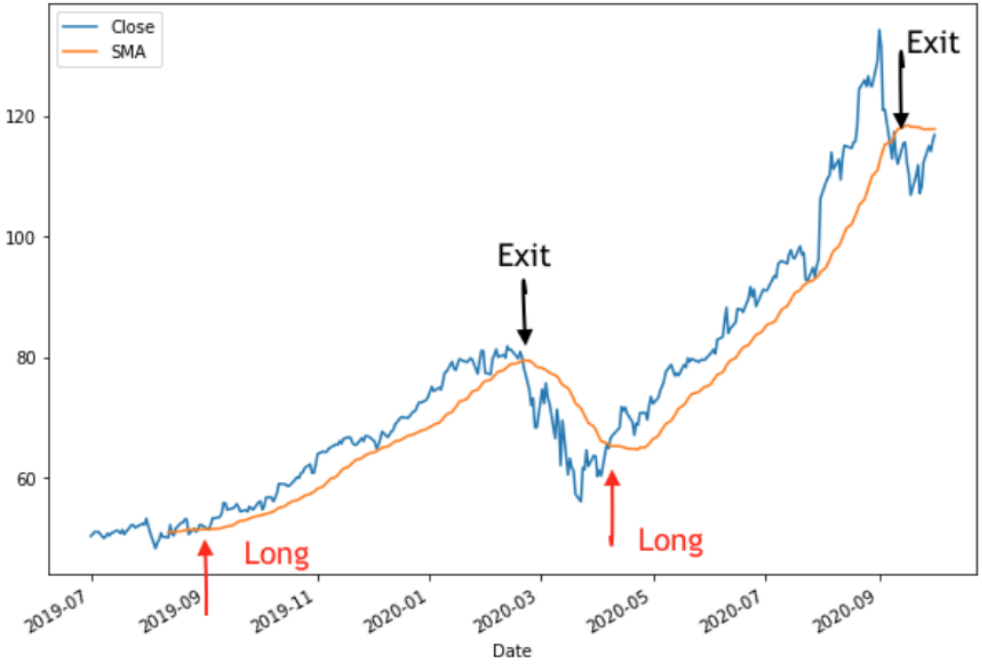
- Measure whether a price is too high or too low on a relative basis:
  - Relatively high: price close to the upper band
  - Relatively low: price close to the lower band

Trading Signal

- Triggers to long or short financial assets based on predetermined criteria
- Can be constructed using:
  - One technical indicator
  - Multiple technical indicators
  - A combination of market data and indicators
- Commonly used in algorithmic trading

Example of Signal

- Signal: Price > SMA (long when the price rises above the SMA)



Two types of trading strategies

Trend-following

- Bet the price trend will continue in the same direction
- Use trend indicators such as moving averages, ADX, etc to construct trading signals

Mean reversion

- Bet the price tends to reverse back towards the mean
- Use indicators such as RSI, Bollinger Bands, etc, to construct trading signals

MA crossover strategy

The trend is your friend.

- Two EMA crossover:
  - Long signal: the short-term EMA crosses above the long-term EMA
  - Short signal: the short-term EMA crosses below the long-term EMA

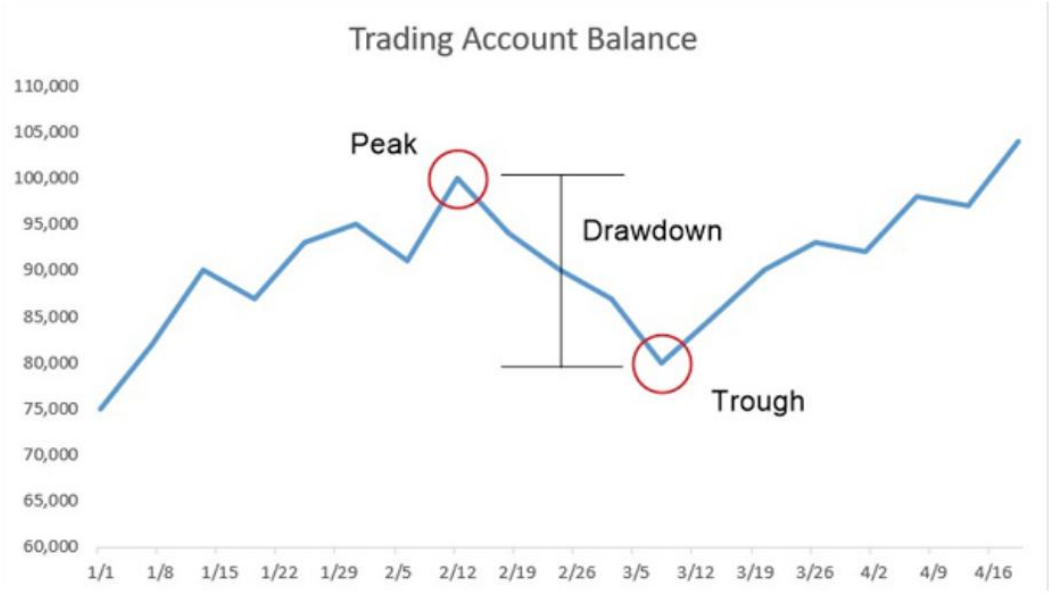
Mean Reversion Strategy

Buy the fear and sell the greed

- RSI-based mean reversion strategy:
  - Short signal: RSI > 70
    - Suggests the asset is likely overbought and the price may soon reverse
  - Long signal: RSI < 30
    - Suggests the asset is likely oversold and the price may soon rally

Drawdown

A drawdown is a peak-to-trough decline during a specific period for an asset or a trading account.

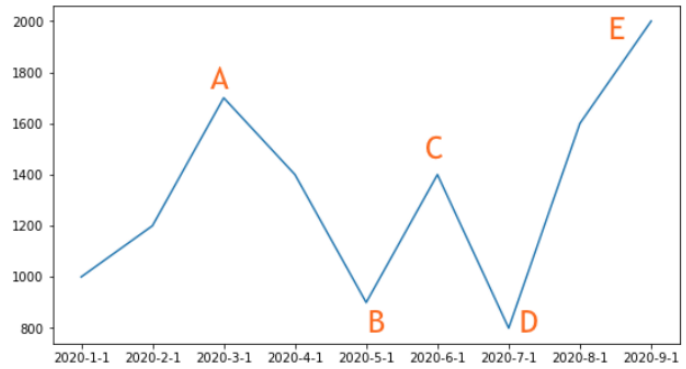


Max Drawdown

$$\text{Max Drawdown} = (V_p - V_l)/V_l$$

V_p: Peak value before the largest drop

V_l: Lowest value before a new high value



Max drawdown

= (Point A value - point D value)/Point A value
= (1700 - 800)/1700 = 53%