# Technical Analysis

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# Learning Objectives

- * Understand principles of technical analysis
- * Evaluate it within portfolio theory
- * Apply indicators in investment decisions

# Lecture Structure

- Intro to TA
- Core tools
- Math & portfolio link
- EMH & evidence
- Case study and discussion

# Technical Analysis Overview

- Definition and purpose
  Technical analysis studies past market data - especially prices and trading volume - in order to make decisions about future trades.

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- Used in portfolio theory context

- Focus on decision-making and timing

# What is Technical Analysis?

- Studies price & volume
  - **fundamental analysis** asks whether an asset is underpriced or overpriced relative to its intrinsic value.
  - **Technical analysis** asks: *what is the market doing right now, and is that movement likely to continue or reverse?*
- Identifies patterns
  - markets often display patterns because investors react gradually, imitate one another, or overreact to news.
- Focus on market behavior

# Key Assumptions

**The three classic assumptions**

1. Prices reflect available information.

2. Prices tend to move in trends rather than jumping randomly all the time.

3. History may repeat itself because investor behavior repeats itself.

# TA in Portfolio Theory

- Portfolio theory is about choosing combinations of assets under risk.
- Technical analysis enters this discussion mainly through
  **timing**,
  **risk management**, and
  **tactical allocation**.

# TA in Portfolio Theory

Why using the TA

- An investor may use technical signals to decide **when** to increase or decrease exposure to equities.
- A manager may use technical rules to reduce losses during strong market downturns.

# TA in Portfolio Theory

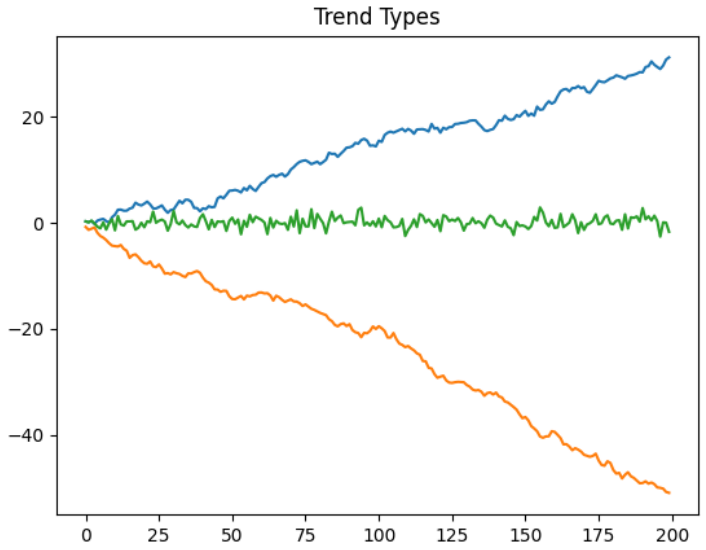
- A portfolio may combine long-run strategic allocation with short-run tactical signals.
- Therefore, technical analysis does not replace portfolio theory. It may complement it.
- Portfolio theory helps answer *what should I hold?*
- Technical analysis often aims to help answer *when should I hold it?*

# Core visual tools -Trend Types

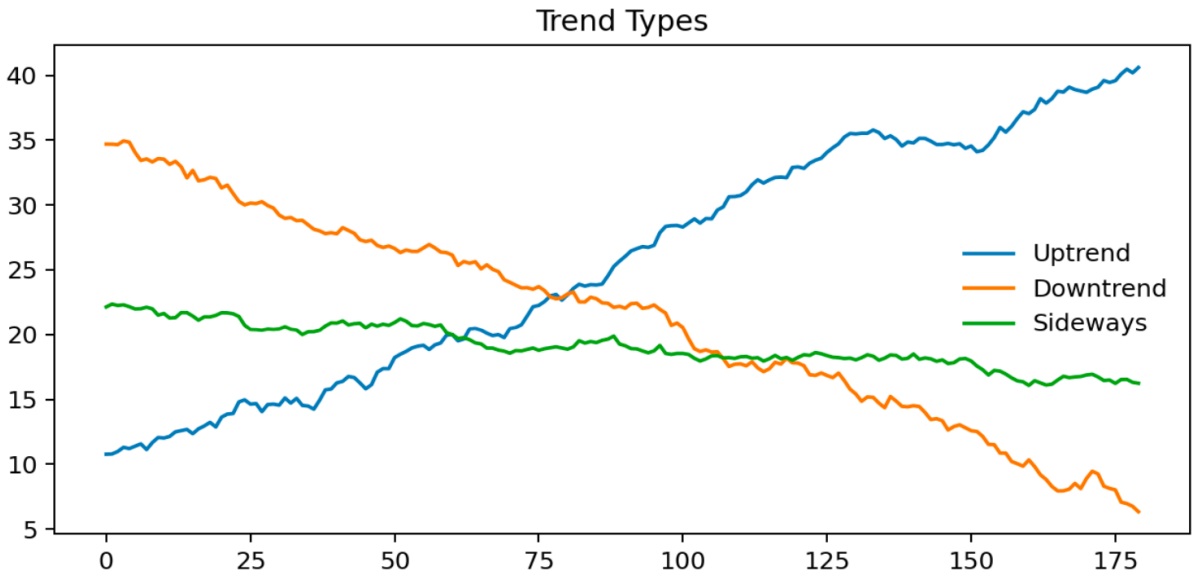
A) TA trend is the general direction of market movement over time.

- An **uptrend** has higher highs and higher lows.
- A **downtrend** has lower highs and lower lows.
- A **sideways market** moves within a range and has no strong direction.

- Charts illustrate differences



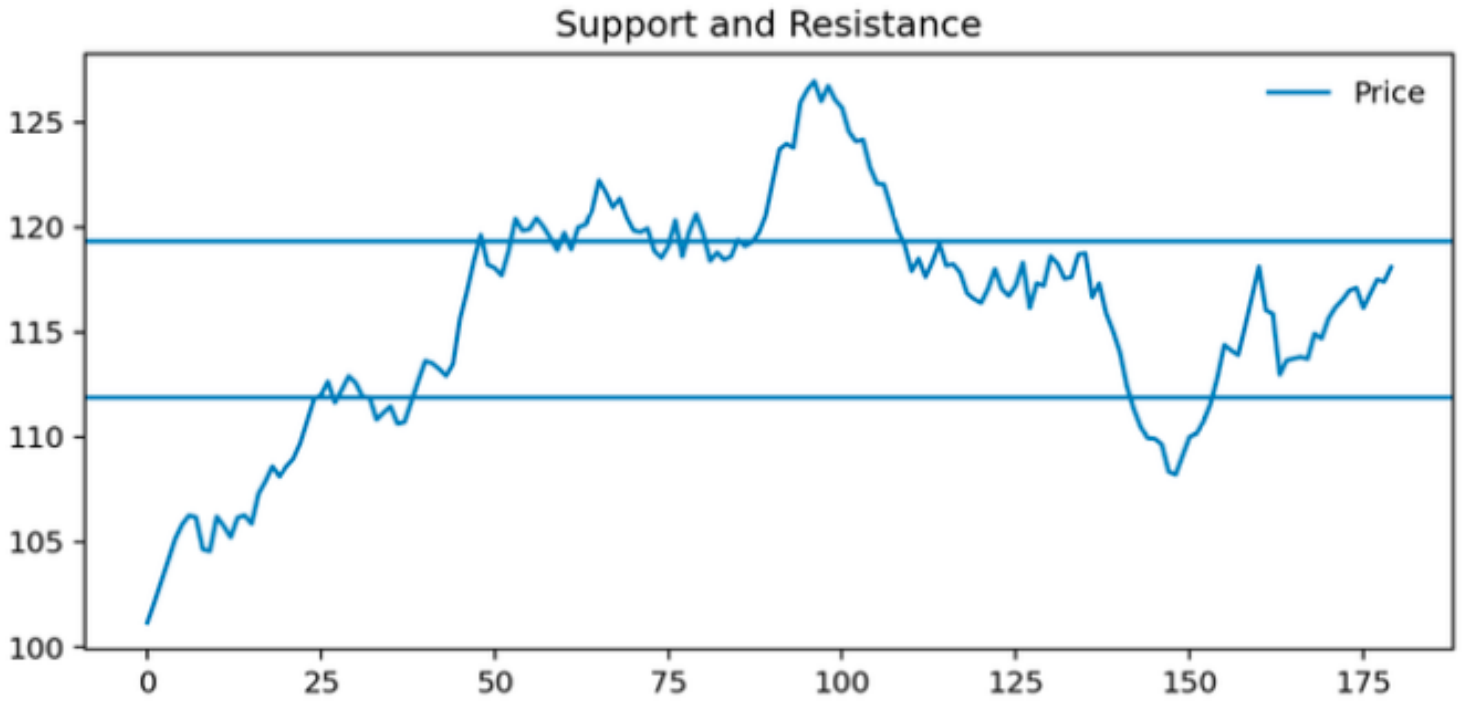
# Core visual tools Trend Types




- Trend analysis matters because many trading rules are trend-following rules.
- They assume that once a price begins moving in one direction, that movement may continue for some time.

# Core visual tools -Support & Resistance

- Support: buying pressure
- Resistance: selling pressure
- Psychological price levels



# Core visual tools -Support & Resistance

- **Support** is a price area where demand tends to appear and stop prices from falling further.

- **Resistance** is a price area where selling pressure tends to appear and stop prices from rising further.

- These levels are often interpreted psychologically. Investors remember past turning points. A level where prices previously bounced may attract buyers again; a level where prices previously failed may attract sellers again.

# Moving Averages

- Smooth price movements
- Short vs long trade-off
- Signals via crossovers

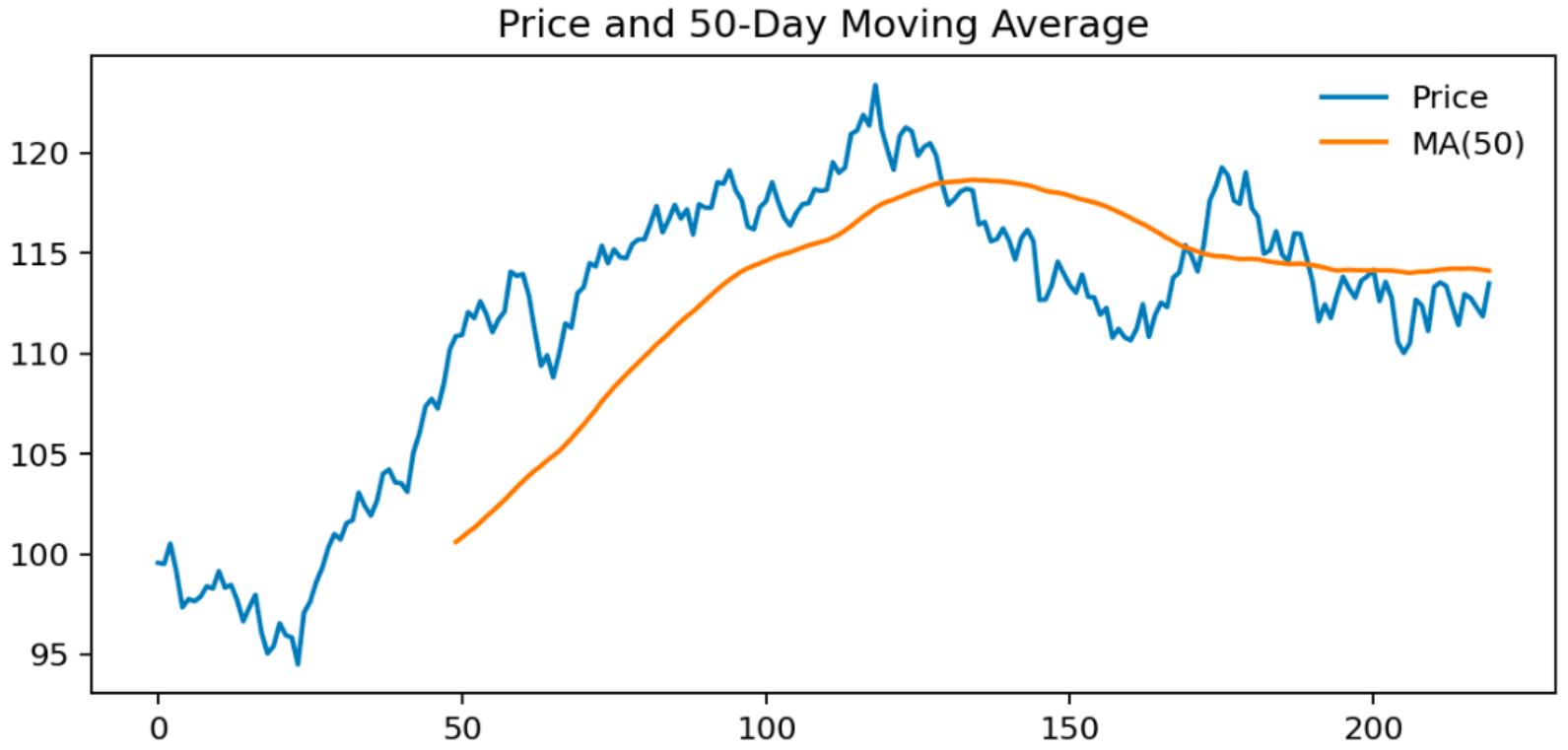
- The simplest version is the arithmetic average of the last *N* prices.

Moving Average = average of the last N observed prices

- Short moving averages react quickly but produce more false signals. Long moving averages react slowly but may better capture major trends.

# Moving Averages

- A common rule is: buy when the price rises above the moving average, and sell when it falls below the moving average.
- Another common rule compares a short moving average with a long moving average.



# Momentum

- Measures strength of trend
- Positive momentum persists
- Risk of reversals

- Momentum measures whether recent price movement has been strong.
- If the price today is much higher than it was some months ago, the asset has positive momentum.

**Simple momentum measure: current price - price k periods ago**

# Momentum

- Momentum is important because one of the most discussed findings in empirical finance is that assets with strong recent performance often continue to perform well over intermediate horizons.

# Simple formal definitions Return Formula

- The return on an asset over one period measures the percentage change in price.

$$R_t = (Pt - Pt\text{-}1) / Pt\text{-}1$$

- Used for comparison
- Basis for performance

# Risk Concept

- Risk is often measured by the variability of returns. If returns change a lot from period to period, the asset is considered riskier.
- Measured via volatility
- Higher variability = higher risk

# Technical Rules

- A technical trading strategy can be thought of as a simple decision rule:

Use past information -> generate a signal -> choose position size

- For example, if price is above the moving average, hold the market; otherwise, move to cash.

- This connects technical analysis to portfolio management because the signal determines portfolio weights over time.

# Efficient Market Hypothesis

- The Efficient Market Hypothesis suggests that past prices should not contain exploitable information about future returns.
- The **weak form** says past prices and returns should not give a reliable advantage.
- The **semi-strong form** says all public information is already reflected in prices.
- The **strong form** says even private information is fully reflected in prices.

- If weak-form efficiency holds perfectly, technical analysis should not work. Yet technical analysis remains widely used in practice.

# Behavioral Finance

- Behavioral finance offers reasons why technical patterns may appear even if markets are competitive.
- Investors may **underreact** to information, so prices adjust gradually.
- Investors may **herd**, meaning they copy the behavior of others.
- Investors may **anchor** on past prices or important round numbers.
- Investors may **overreact**, causing reversals after strong moves.
- These ideas help explain why momentum may appear over some horizons and why reversals may appear over others.

# Empirical Evidence

- Research often finds that price continuation over medium horizons exists in many markets, which supports momentum-style strategies.
- Trend-following has also been studied across asset classes
- Transaction costs, taxes, slippage, and changing market conditions can reduce or eliminate profits in real implementation.
- Evidence for momentum has been documented in academic finance.
- Trend-following strategies have also been studied across asset classes.
- Results are not constant across all periods; some strategies experience crashes or long weak periods.

# Case Study Setup

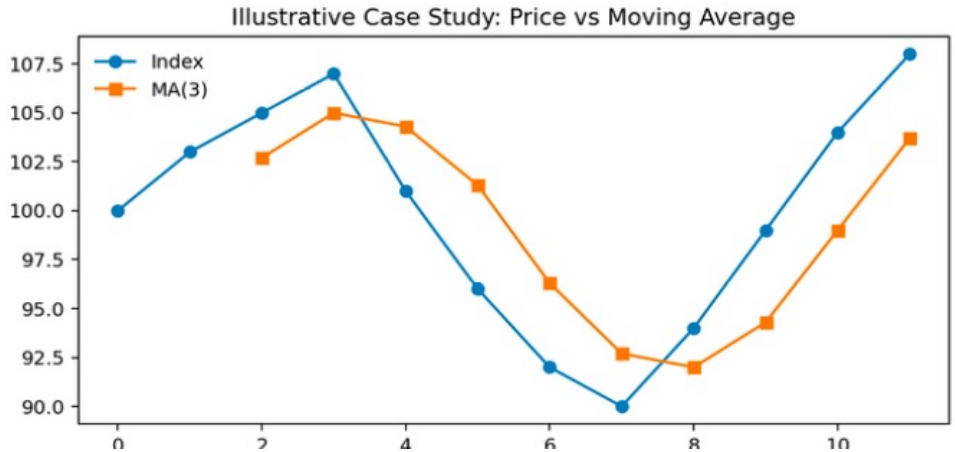
- The following example is designed for class discussion. It is **illustrative** rather than a full historical backtest, but it shows exactly how a technical rule can be translated into portfolio decisions and compared with buy-and-hold.

**Rule used in the case**

- Asset: a broad market index.
- Signal: compare price with a short moving average.
- Position rule: hold the index when price is above the moving average; otherwise hold cash.

# Case Study Table Insight

- Signals switch based on MA
- Shows buy/sell timing
- Illustrates rule mechanics




| Month | Index | MA(3) | Monthly return % | Signal |
|---|---|---|---|---|
| M1 | 100 | - | - | - |
| M2 | 103 | - | 3.0 | - |
| M3 | 105 | 102.7 | 1.9 | Buy |
| M4 | 107 | 105.0 | 1.9 | Buy |
| M5 | 101 | 104.3 | -5.6 | Sell |
| M6 | 96 | 101.3 | -5.0 | Sell |
| M7 | 92 | 96.3 | -4.2 | Sell |
| M8 | 90 | 92.7 | -2.2 | Sell |
| M9 | 94 | 92.0 | 4.4 | Buy |
| M10 | 99 | 94.3 | 5.3 | Buy |
| M11 | 104 | 99.0 | 5.1 | Buy |
| M12 | 108 | 103.7 | 3.8 | Buy |

# Case Study Interpretation

In the example above, the strategy participates in the market when the signal is positive and steps aside when the signal is negative. This type of rule is common because it is easy to explain and easy to implement conceptually.

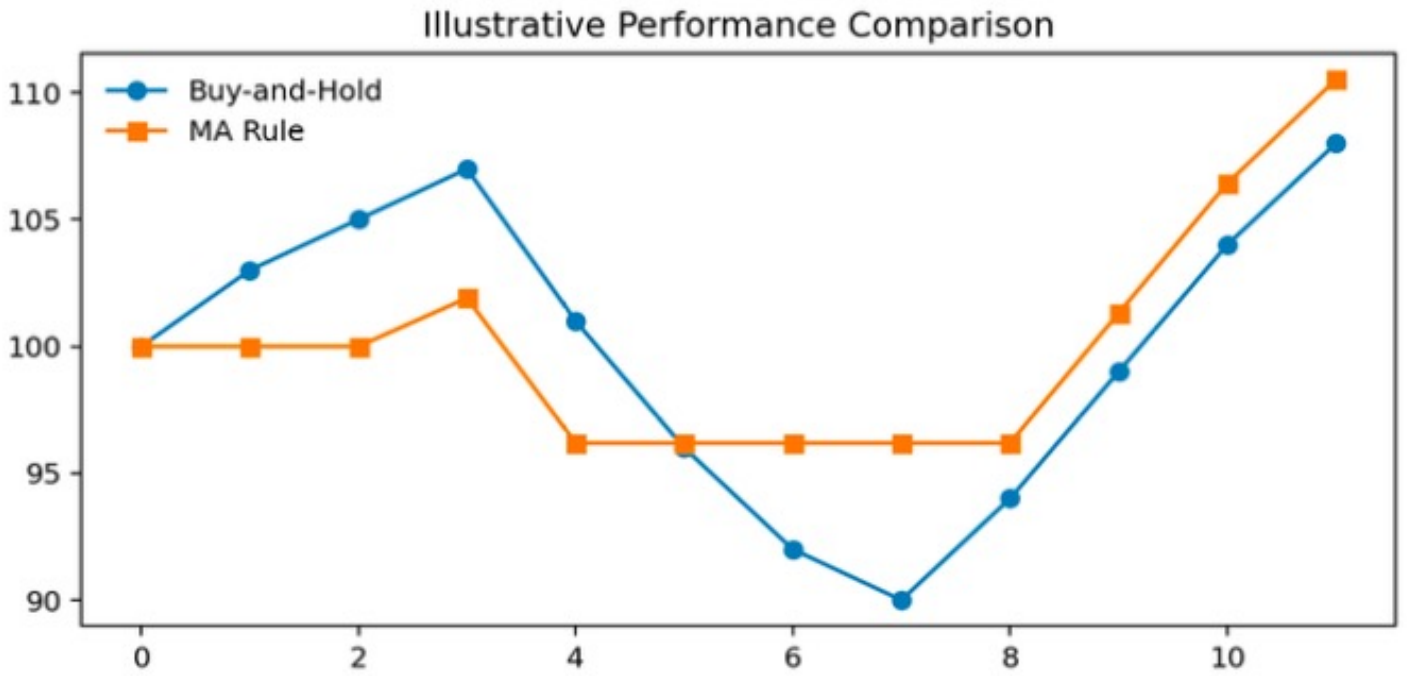
# Case Study Interpretation

- The moving-average rule may protect capital during falling markets because it exits after the trend turns negative.
- The rule may underperform during fast recoveries because it re-enters late.
- The rule can suffer from **whipsaw**: repeated buy and sell signals in sideways markets.
- The key benefit is often better **downside control**, not necessarily a much higher average return.

This is why technical analysis matters in portfolio theory. Some investors care as much about avoiding large losses as they do about max

# Performance Comparison

- MA vs Buy & Hold
- Focus on drawdown reduction
- Trade-off vs return



# Performance Evaluation

- A strategy should not be judged only by how much money it makes in the best scenario. Students should compare performance using several dimensions:
  - Average return
  - Volatility of returns
  - Maximum drawdown
  - Number of trades and trading costs
  - Consistency across time

# Sharpe Ratio

- (Return - rf) / volatility
- Measures risk-adjusted return

The Sharpe ratio measures excess return per unit of risk. At bachelor level, students do not need the full derivation to understand the intuition.

If two strategies have similar returns, the one with lower volatility has the higher Sharpe ratio. This is one reason technical rules can still be attractive even when they do not dominate buy-and-hold in raw return terms.

# Drawdown

- Loss from peak
- Important for investor behavior

- Drawdown measures how far a portfolio falls from a previous peak.
- Large drawdowns are psychologically difficult and often economically costly because investors may sell at the wrong time.

# Advantages of TA

- Easy to communicate and visualize.
- Useful for timing and risk-management discussions.
- Applicable across many assets.
- Can complement fundamental analysis.

# Limitations of TA

- Rules can be oversimplified and overfitted.
- Past success does not guarantee future success.
- Trading costs can destroy apparent profits.
- Signals can fail badly during regime changes.
- Different indicators may give conflicting messages.

# Exercises

- Compute return
- Sharpe ratio
- Interpret case study

# Final Takeaways

- TA supports timing & risk control
- Not guaranteed profit
- Evaluate using risk + return