Technical Analysis

A Language of the Market

Acknowledgement:
Most of the slides were originally from CFA Institute and I adapted them for QF206
https://www.cfainstitute.org/learning/products/publications/inv/Documents/Forms/AllItems.aspx
Learning Outcomes

- Explain the principles of technical analysis, its applications, and its underlying assumptions.
- Discuss the construction and interpretation of different types of technical analysis charts: line, bar, candlestick, and point & figure.
- Demonstrate the uses of trend, support and resistance lines.
- Identify and interpret common chart patterns.
- Discuss common technical analysis indicators: price-based indicators, momentum oscillators, sentiment, and flow of funds.
- Discuss the key tenets of Elliott Wave Theory and the importance of Fibonacci numbers.
- Describe intermarket analysis and its application.
- Hands-on experience!
- Project!
The Logic of Technical Analysis

Supply and demand determine prices

Changes in supply and demand cause changes in prices

Prices can be projected with charts and other technical tools
Assumptions of Technical Analysis

- Human behavior is often erratic and driven by emotion.
- Market trends and patterns reflect irrational human behavior.
- Trends and patterns repeat themselves and are thus predictable.
Charts: Visualization of Price Dynamics

- Point and Figure Chart
- Line Chart
- Candlestick Chart
- Bar Chart
Line Charts

Dow Jones Industrial Average on a Linear Scale, 1928–2010 (in U.S. dollars)

Dow Jones Industrial Average on a Logarithmic Scale, 1928–2010
Bar Charts

Bar Chart: Bovespa Index, November 2007–November 2009 (in Brazilian reals)
Candlestick Charts

Candlestick Notation

Each candle has two elements: body and wick/shadow.

- White body means market closed UP (Close > Open).
- Dark body means market closed DOWN (Close < Open).

Weekly Candlestick Chart

- **Very Bullish**
- **Doji**
Point and Figure Charts
Constructing a Point-and-Figure Chart

- Let the box size be 1, and the reversal size be three.

- X represents an increase in price and O represents a decline in price.

- If the price does not increase or decrease by at least the box size, no indication is made on the chart.

- Start a new column to the right only when at least three X’s or O’s appear because the reversal size is set at three. Otherwise, no update.
Price and Volume

Price Is Trending Higher or Lower

Volume Is Increasing

Confirmation: Trend Will Continue

Volume Is Decreasing

Divergence: Trend Will End
Relative Strength Analysis

HOG vs. S&P 500 and RODM vs. the S&P 500, January–June 2009

Relative Strength

Underperformance

Outperformance

Jan/09 Feb/09 Mar/09 Apr/09 May/09 Jun/09 Jul/09

RODM ······ HOG

HOG vs. S&P 500 and RODM vs. the S&P 500, January–June 2009
Relative Strength Analysis: SingTel/SIMSCI
Trend Analysis


- **Uptrend**
  - Higher Highs
  - Higher Lows
  - Demand Exceeds Supply

- **Downtrend**
  - Lower Highs
  - Lower Lows
  - Supply Exceeds Demand
Support and Resistance

- **Support**: A low price range in which buying activity is sufficient to stop a decline in price.
- **Resistance**: A high price range in which selling activity is sufficient to stop a rise in price.
- **Change in Polarity**: Once a resistance (support) level is breached, it becomes a support (resistance) level.
Chart Patterns

Reversal Patterns
- Head and Shoulders or Inverse Head and Shoulders
- Double Tops or Bottoms
- Triple Tops or Bottoms

Continuation Patterns
- Triangles
- Rectangles
- Flags and Pennants
(Head and Shoulders) Price target = Neckline – (Head − Neckline)
(Inverse Head and Shoulders) Price target = Neckline + (Head − Neckline)
Double Tops and Bottoms

Triple Tops and Bottoms

Triple-Top Pattern: Rockwell Automation Daily Price Chart, 1999 (price in U.S. dollars)
Triangles

Ascending Triangle Pattern

Descending Triangle Pattern
Rectangle Patterns

Bullish Rectangle

Bearish Rectangle
Pennant Formation: China Mobile ADR, November 2006–July 2009 (price in U.S. dollars)
Technical Indicators

- Price-Based Indicators
- Momentum Oscillators
- Sentiment Indicators
- Flow-of-Funds Indicators
Price-Based Indicator: Moving Average

Daily Price Chart with 20-Day and 60-Day Moving Averages: Gazprom EDR, November 2007–August 2009 (price in euros)
Simple Moving Average

Daily Closing Prices: 11,12,13,14,15,16,17

First day of 5-day SMA:
\[
\frac{11 + 12 + 13 + 14 + 15}{5} = 13
\]

Second day of 5-day SMA:
\[
\frac{12 + 13 + 14 + 15 + 16}{5} = 14
\]

Third day of 5-day SMA:
\[
\frac{13 + 14 + 15 + 16 + 17}{5} = 15
\]
Exponential Moving Average


SMA: 10 period sum / 10

Multiplier: 2/(Time periods + 1)
            = 2/(10 + 1) = 0.1818 (18.18%)

EMA: {Close - EMA(previous day)}×multiplier + EMA(previous day).
## Numerical Examples

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<th>Smoothing Constant 2/(10 + 1)</th>
<th>10-day EMA</th>
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Momentum Oscillator: MACD Oscillator

MACD and Daily Price Chart: Exxon Mobil, March–November 2005

MACD and Signal Line

MACD Line

Signal Line

MACD and Daily Price Chart: Exxon Mobil, March–November 2005

MACD and Daily Price Chart: Exxon Mobil, March–November 2005
Formula of MACD

MACD Line: (12-day EMA - 26-day EMA)

Signal Line: 9-day EMA of MACD Line

MACD Histogram: MACD Line - Signal Line
Momentum Oscillator: Rate of Change Oscillator

Momentum Oscillator with 100 as Midpoint: Toyota Motor, May 2008–October 2009 (price in Japanese yen)
## Formula of Rate of Change

ROC = [(Close - Close n periods ago) / (Close n periods ago)] × 100


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<td>8 7-May-10</td>
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Momentum Oscillator: Relative Strength Index

Candlestick Chart with RSI: Ford, January–August 2009 (price in U.S. dollars)
Formula of Relative Strength Index

\[
RSI = 100 - \frac{100}{1 + RS}
\]

\[
RS = \frac{\sum \text{(Up changes for the period under consideration)}}{\sum (|\text{Down changes for the period under construction}|)}
\]

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Momentum Oscillator: Stochastic Oscillator


© Christopher Ting
Formula of Stochastic Oscillator

\[
\%K = 100 \left( \frac{C - L_{14}}{H_{14} - L_{14}} \right)
\]

\%D = Average of the last three \%K values calculated daily

where

\[C = \text{latest closing price}\]
\[L_{14} = \text{lowest price in past 14 days}\]
\[H_{14} = \text{highest price in past 14 days}\]

\%K is the faster moving line. The \%K value means that the latest closing price \((C)\) was in the \%K percentile of the high–low range \((L_{14} \text{ to } H_{14})\).
Price-Based Indicator: Bollinger Band

Formula of Bollinger Bands

Upper Band = 60-day SMA + (60-day standard deviation of price × 2)

Middle Band = 60-day simple moving average (SMA)

Lower Band = 60-day SMA - (60-day standard deviation of price × 2)
Volatility Measure: ATR

**True Range (TR)** is defined as the greatest of the following:

A. Current High less the current Low
B. Current High less the previous Close (absolute value)
C. Current Low less the previous Close (absolute value)

**Average True Range (ATR)** is a measure of volatility, typically based on 14 periods:

\[
\text{Current ATR} = \frac{[(\text{Prior ATR} \times 13) + \text{Current TR}]}{14}
\]

- Multiply the previous 14-day ATR by 13.
- Add the most recent day’s TR value.
- Divide the total by 14
True Range

Sentiment Indicator: Opinion Polls

- Investors Intelligence Advisors’ Sentiment Report
- Market Vane Bullish Consensus
- Consensus Bullish Sentiment Index
- Daily Sentiment Index
- AAII Investor Sentiment Survey
Sentiment Indicator: Calculated Statistical Indices

Put/Call Ratio
- Normally below 1.0
- Considered a contrary indicator

CBOE Volatility Index
- Based on options on stocks in the S&P 500
- Used with trend, pattern, or oscillator tools

Margin Debt
- Rising margin debt believed to be a signal of aggressive buying
- Considered a contrary indicator

Short Interest Ratio
- Short interest ÷ Average daily trading volume
- Considered a contrary indicator
Flow-of-Funds Indicator: Arms Index (TRIN)

Arms Index = \frac{\text{Number of advancing issues}}{\text{Number of declining issues}} \div \frac{\text{Volume of advancing issues}}{\text{Volume of declining issues}}

Arms Index for the S&P 500, January–July 2009
Other Flow-of-Funds Indicators

**Margin Loans**
- Ability to buy stock on margin may increase demand
- Declining margin balances may result in forced selling

**Mutual Fund Cash Positions**
- Considered a contrary indicator: High cash balances represent buying power
- Some analysts take into account the level of interest rates

**New Equity Issuance and Secondary Offerings**
- Considered a contrary indicator: High issuance and offerings are considered signs of a market top
Cycles

Kondratieff Wave (K-wave)
- Western economies have a 54-year cycle
- Originally tied to economic cycles and commodity prices

18-Year Cycle
- $3 \times 18$ years = 54 years
- Most often mentioned in connection with real estate prices

Decennial Pattern
- Pattern of market returns broken down based on the last digit of a year
- Years ending in 5 have the best returns

Presidential Cycle
- Returns broken down by year of U.S. President’s term in office
- Third year (year prior to next election) has best historical performance
Elliott Wave Theory

Grand Supercycle
Supercycle
Cycle
Primary
Intermediate
Minor
Minute
Minuette
Subminuette

Follow patterns that are ratios of Fibonacci Sequence: 0, 1, 1, 2, 3, 5, 8, 13, 21…
Impulse Waves and Corrective Waves

Impulsive (Numbered) Phase

Corrective (Lettered) Phase

Wave 1
Wave 2
Wave 3
Wave 4
Wave 5
Intermarket Analysis

Inflection points in one market

May be a warning sign of a change in trend in another market

Summary

- Principles, applications, and assumptions of technical analysis
- Construction and interpretation of charts
- Trend, support, and resistance lines, and change in polarity
- Common technical analysis patterns, indicators, and cycles
- Elliott Wave Theory
- Inter-market analysis