Quantitative Trading Module

From Order Execution and Portfolio Protection to Price Action Strategy

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Outline

- **Market Structure and Order Execution**
  - Market, Limit, and Conditional Orders (AON, FOK, IOC)
  - Stop Orders and Risk Management Strategies
- **Portfolio Protection and Diversification**
  - Non-Correlated Assets and Beta Analysis
  - Capital Protection with Options and Principal-Protected Notes
- **Systematic Momentum and Technical Levels**
  - Momentum Lookback Horizons and Crossover Strategies
  - Support, Resistance, and Action-Reaction Breakouts
- **Candlestick Patterns and Price Action**
  - Candlestick Structure and Relative Positions (Trigrams)
  - Reversal Patterns: Head and Shoulders Mechanics

Course Reference:
Futuretesting Quantitative Strategies
`http://ssrn.com/abstract=4647103`

From Order Execution and Portfolio Protection to Price Action Strategy

Market vs. Limit Orders

Market Order

- Executed immediately at the best available price.
- Guarantees execution, but not the execution price.
- Exposure to slippage if prices move rapidly.
- Best suited to liquid, stable markets.

Limit Order

- Executed only at the specified price or better.
- Guarantees price, but not execution.
- Particularly useful in volatile or thinly traded markets.
- Execution depends on the **bid–ask spread**.

Key trade-off: market orders prioritise speed, limit orders prioritise control.

Conditional Orders

- **All-or-None (AON):** Order must be filled in its entirety in a single trade; otherwise, it remains open.
- **Fill-or-Kill (FOK):** Order must be filled completely and immediately; if not, it is cancelled.
- **Immediate-or-Cancel (IOC):** Any available portion is filled immediately; the remainder is cancelled.
- Primarily used by large traders to avoid partial fills or adverse price movement.
- **Key distinction:** AON can wait, FOK cannot, IOC allows partial execution.

Stop Orders for Risk Management

- **Stop Order (Stop-Loss):** Converts into a market order once the stop price is reached.
- **Stop-Limit Order:** Converts into a limit order when the stop price is triggered.
- **Trailing Stop:** Moves with favourable price action, locking in gains while limiting downside risk.
- **Bracket Orders:** Combine a downside stop with an upside profit target in a single structure.

Stops enforce discipline, but may be triggered by short-term market noise.

Short Selling Mechanics

- **Short Sale:** Borrow shares, sell them at the current market price, and aim to repurchase later at a lower price.
- **Buy to Cover:** Repurchase shares in the market to return the borrowed position.
- Profit is realised if prices fall; losses occur if prices rise.
- **Key risks:**
  - Potentially unlimited losses if prices rise sharply.
  - Margin requirements and the possibility of margin calls.
- **Example:** Short GE at \$12.50, cover at \$10.50 $\Rightarrow$ \$2 per share profit.

Diversification and Non-Correlated Assets

- **Diversification:**
  - Spread exposure across industries, asset classes, and geographies.
  - Reduces unsystematic (company-specific) risk.
  - Excessive diversification may dilute returns.
- **Non-Correlated Assets:**
  - Incorporate bonds, commodities, real estate, or currencies alongside equities.
  - Helps mitigate systematic (market-wide) risk.
  - $\beta > 1$: more volatile than the market; $\beta < 1$: less volatile.

Protecting Gains with Options and Stops

- **Put Options:**
  - Act as insurance against falling prices.
  - Example: buying a $105 put when the stock trades at $100 caps downside risk.
- **Stop-Loss Orders:**
  - **Hard stop:** fixed exit level.
  - **Trailing stop:** adjusts with price movements, preserving upside.
- **Key principle:** Accepting small losses is preferable to allowing gains to reverse into losses.

Income and Capital Protection

- **Dividends:**
  - Provide a steady income stream and cushion during market downturns.
  - Historically represent a significant component of total equity returns.
  - **Dividend Aristocrats**: companies with 25+ consecutive years of dividend increases.
- **Principal-Protected Notes:**
  - Structured products combining bond-like capital protection with equity upside.
  - Example: $800 invested in a zero-coupon bond and $200 in call options on an index.
  - Designed to guarantee return of principal at maturity.

Chart Patterns as Protection Tools

- Common patterns include head & shoulders, triangles, rectangles, and cups & handles.
- These patterns help identify:
  - Entry points.
  - Stop-loss levels for risk control.
  - Profit targets for exit planning.
- **Key risk:** False breakouts or breakdowns may trigger premature exits.
- Most effective when combined with confirming indicators such as volume, momentum, or moving averages.

Trading Periods and Momentum Strategies

- **Lookback period:** the historical window over which past performance is measured.
- Common momentum horizons:
  - 3-month ($\approx$ 63 trading days),
  - 6-month ($\approx$ 126 trading days),
  - 12-month ($\approx$ 252 trading days),
  - 12–1 momentum: excludes the most recent month (mitigates short-term reversals),
  - 12–2 momentum: excludes the most recent two months.
- Widely used in quantitative strategies and factor investing to capture the momentum premium.

The Importance of Timing

- In modern electronic markets, execution is easy — **timing** is the real challenge.
- **Entry point:** the price at which a position is opened.
- **Exit point:** the price at which a position is closed.
- The success of any strategy depends on disciplined, pre-defined entry and exit rules.
- The objective is to capture momentum *before* peaks or troughs are fully formed.
- **Technical Analysis (TA):** uses historical price patterns and indicators to anticipate short-term price movements.

No trading strategy is complete without a clearly defined entry and exit framework.

Support, Resistance, and Pullbacks

- **Support:** a price level acting as a *floor*, where buying pressure tends to emerge.
- **Resistance:** a price level acting as a *ceiling*, where selling pressure tends to appear.
- **Pullback:** a temporary counter-move toward a moving average or support level within an existing trend.

Practical Use

- Buy pullbacks in an uptrend when price approaches support or a key moving average.
- Sell rallies in a downtrend as price nears resistance.
- A decisive breach of support or resistance often signals a potential breakout or trend change.

Support defines opportunity, resistance defines risk — breaks define regime change.

Trading Volume as Confirmation

- **Volume:** the total number of shares (or contracts) traded over a given period.
- Rising prices accompanied by **high volume** signal strong bullish conviction.
- Falling prices accompanied by **high volume** confirm bearish pressure.
- **Low volume** suggests weak conviction and increases the likelihood of false moves or reversals.

Practical Insight

Chart patterns such as head & shoulders, flags, and pennants rely on **volume expansion** to validate breakouts or reversals.

Moving Average Crossovers

- Strategy based on the interaction of two moving averages: one short-term and one long-term.
- **Bullish signal:** the short-term MA crosses above the long-term MA.
- **Bearish signal:** the short-term MA crosses below the long-term MA.
- Example: a 20-day moving average crossing a 100-day moving average.
- **Advantages:** clearly identifies trend direction and momentum.
- **Limitations:** lagging by construction; prone to false signals in range-bound markets.

Chart Patterns and Consolidation

- **Consolidation:** a period of sideways price movement bounded by support and resistance.
- Often represents a pause as the market digests prior gains or losses.
- **Continuation patterns:** temporary consolidations that typically resolve in the direction of the prevailing trend.
- Breakouts from consolidation zones are frequently followed by sharp, directional moves.
- Common patterns include flags, pennants, triangles, and rectangles.

Chart Patterns and Consolidation

Exit Strategies Overview

- Exiting a position effectively is often more challenging than entering one.
- Exit decisions are particularly vulnerable to emotional bias if not planned in advance.
- A well-defined exit strategy is essential for risk control and capital preservation.
- Common exit techniques include:
  - Limit and take-profit orders.
  - Stop-loss and protective stop orders.
  - Trailing stop mechanisms.
  - Scaling out of positions over time.

Limit and Take-Profit Orders

- **Limit order:** closes a long position at a higher target price, or a short position at a lower target price.
- **Take-profit order:** automatically exits a position once a predefined profit level is reached.
- Take-profit levels are commonly set using:
  - Key support and resistance levels.
  - Fibonacci extensions or measured moves.
  - Dynamic targets such as moving averages in trending markets.
  - Price action signals (e.g., engulfing patterns or exhaustion bars).

Stop-Loss and Protective Stops

- **Stop-loss:** an automatic exit triggered when price moves beyond a predefined adverse level.
- Serves as the primary defence against large, uncontrolled losses.
- Example: buy at \$50 with a stop at \$40 $\Rightarrow$ maximum loss of \$10 per share.
- **Trailing stop:** adjusts upward as price rises, locking in gains while limiting downside.
- **Protective stop:** applied to profitable positions to guarantee a minimum realised profit.

Stops transform emotional decisions into consistent, rule-based discipline.

Trailing Stops and Scaling Exits

- **Trailing stop:**
  - Automatically moves in the trader's favour as price advances.
  - Preserves upside potential while limiting downside risk.
  - Distance is commonly defined as a fixed percentage or an ATR multiple.
- **Scaling exits:**
  - Raise stops to break-even once the trade becomes profitable.
  - Exit positions in stages (e.g., partial profit at intermediate targets).
  - Balances profit protection with the ability to let winners run.

Overview of Chart Patterns

Patterns are distinctive formations created by price movements over time. They are identified by connecting common price points (highs, lows, or closes) within a given interval.

- Provide structured insight into what the market *may do next*.
- Used to design entry, exit, and risk-management rules.
- Broadly classified into three categories:
  1. **Continuation:** temporary pauses within an existing trend (e.g., flags, triangles).
  2. **Reversal:** signals of a potential trend change (e.g., head & shoulders, double tops/bottoms).
  3. **Bilateral:** price may break in either direction under heightened uncertainty.

Thomas identified 47 distinct chart patterns; several of the most common are shown next.

Examples of Chart Patterns

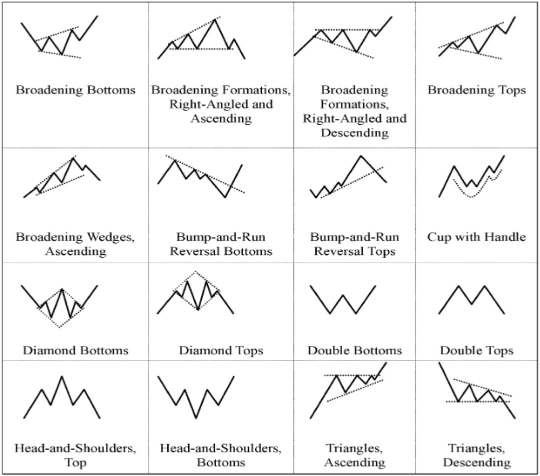

Figure 1: Examples of common chart patterns.

Support and Resistance

- **Support (floor):** a price level where demand tends to prevent further decline.
- **Resistance (ceiling):** a price level where supply tends to prevent further advance.
- These zones frequently serve as natural entry and exit reference points.
- Common tools for identification include trendlines and moving averages.

Support and Resistance

Figure 2: Support and resistance illustrated through price curves.

Breakouts and Breakdowns

Definitions

- **Breakout:** a decisive price move above resistance or below support, often initiating a new trend.
- **Breakdown:** the bearish counterpart, characterised by a strong move below support.

Three typical phases:

1. **Action:** initial impulse through the support or resistance level.
2. **Reaction:** short-term pullback or retest of the breached level.
3. **Resolution:** continuation in the breakout direction or a failed move and reversal.

Action–Reaction Breakout

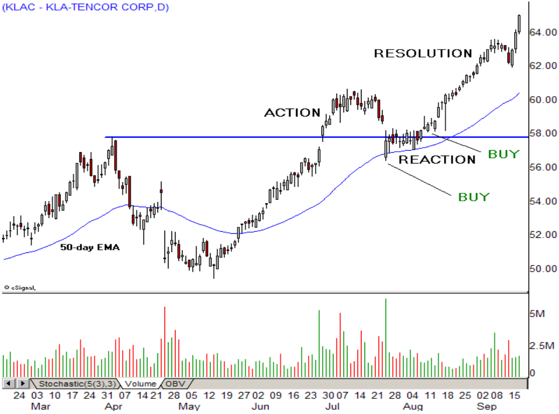

Figure 3: Action–reaction structure following a breakout.

Figure 4: Action–reaction structure following a breakdown.

Confluence in Technical Analysis

Confluence refers to the alignment of multiple signals or levels that reinforce a trading decision.

- **Indicators:** combinations such as MACD with RSI, or moving averages with stochastic oscillators.
- **Fundamentals:** confirmation of technical signals using macro data or earnings information.
- **Order book:** depth and volume analysis supporting observed price action.
- **Technical levels:** intersections of trendlines, horizontal levels, Fibonacci retracements, or channels.

Confluence in Technical Analysis

What are Candlesticks?

- Candlesticks are constructed from price data: open, high, low, and close.
- They visually encode market psychology and short-term price dynamics.
- Each candle summarises sentiment over the selected time frame.
- Primary use: identifying **patterns** that signal potential reversals or trend continuation.

What are Candlesticks?

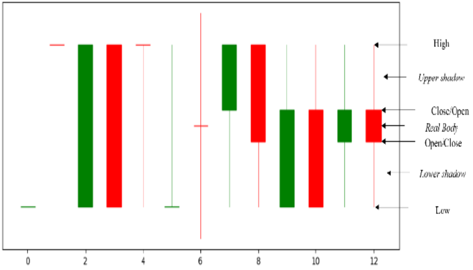

Figure 5: Basic candlestick structure and interpretation.

Candlestick Structure

- **Real body:** the distance between the open and close prices.
  - Close $>$ Open $\Rightarrow$ bullish candle (white/green body).
  - Close $<$ Open $\Rightarrow$ bearish candle (black/red body).
- **Wicks (shadows):** indicate the highest and lowest traded prices.
- **Range:** defined as High $-$ Low, capturing total price movement.

Interpretation of Market Behaviour

- High volatility typically produces longer bodies and wicks.
- Strong momentum is often reflected in consecutive candles of the same colour.

Relative Positions (Trigrams)

Definition

A candlestick pattern consists of one or more candles whose *relative positions* convey market intent. Common patterns span 1-day, 2-day, or 3-day combinations.

Candles are classified according to their relative highs, lows, and closes:

- **BullishHorn / BearHorn:** wide oscillations with strong directional closes.
- **BullishHigh / BearHigh:** new highs formed with strong or weak closing prices.
- **BullishLow / BearLow:** new lows accompanied by strong or weak closes.
- **BullishHarami / BearHarami:** small real body fully contained within the prior candle's range.

These relative formations help traders anticipate reversals or trend continuation.

Candlestick Patterns

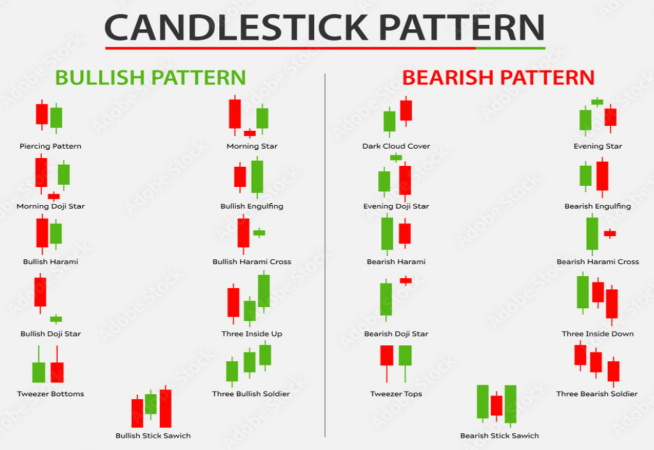

Chart Patterns and Price Action

Price Action (PA) describes how a security's price evolves over time. **Price Action Trading (PAT)** focuses almost exclusively on these price movements, largely ignoring external variables.

Because market participants tend to react in recurring ways, price action often forms recognisable **patterns**. These patterns are observed on OHLC candlestick charts and are commonly used to generate buy and sell signals.

Why use patterns?

- Simplify analysis relative to modelling many economic variables,
- Capture repeated market psychology (fear and greed),
- Identify potential reversal or continuation points.

Patterns are most informative when they form at **confluence points**, such as trendlines, support and resistance levels, or Fibonacci retracements.

Head and Shoulders

A classic **reversal pattern** that signals a transition from a bullish to a bearish trend.

Key characteristics:

- Three peaks, where the central peak (**head**) is higher than the two outer peaks (**shoulders**),
- Each peak retraces toward a common support level known as the **neckline**,
- A decisive break below the neckline confirms the bearish reversal.

The pattern reflects weakening buying pressure: successive rallies fail to reach new highs, indicating loss of momentum before trend reversal.

Head and Shoulders

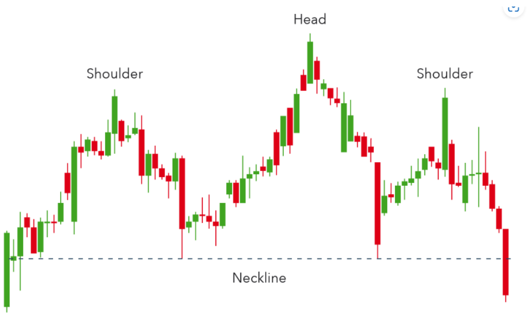

Figure 6: Head and Shoulders reversal pattern

Double Top & Double Bottom

Double Top (*bearish reversal*):

- Price forms two consecutive peaks near a resistance level,
- Failure to break higher signals exhaustion of buying pressure,
- Breakdown below support confirms a shift toward selling dominance.

Double Bottom (*bullish reversal*):

- Price forms two consecutive troughs near a support level,
- Selling pressure weakens after the second trough,
- Breakout above resistance confirms renewed bullish sentiment.

Double Top & Double Bottom

Figure 7: Double Top (left) and Double Bottom (right)

Cup and Handle

A well-known **bullish continuation pattern** that reflects accumulation followed by a controlled consolidation.

- **Cup:** A rounded bottom, similar to a double bottom, indicating gradual accumulation and recovery,
- **Handle:** A short-term consolidation or pullback after the cup formation,
- A breakout above resistance confirms continuation of the prevailing bullish trend.

Cup and Handle

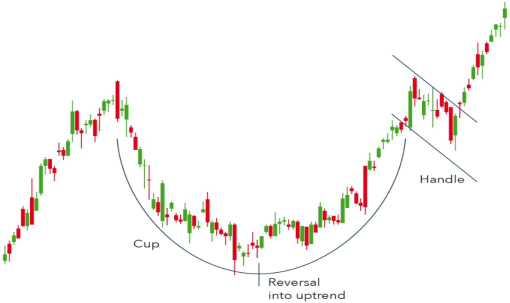

Figure 8: Cup and Handle continuation pattern

Wedges

Wedges form as price compresses between two converging, sloping trendlines. Both structures are typically interpreted as **reversal patterns**.

Rising wedge (*bearish*):

- Both trendlines slope upward, with the support line rising faster than resistance,
- Upward momentum weakens despite higher prices,
- A downside breakout signals a potential bearish reversal.

Falling wedge (*bullish*):

- Both trendlines slope downward, with resistance declining faster than support,
- Selling pressure gradually fades,
- An upside breakout signals a potential bullish reversal.

Wedges: Examples

Figure 9: Rising Wedge (left) and Falling Wedge (right)

Triangles

Triangles form when price action converges through higher lows and/or lower highs, creating a tightening range prior to a breakout.

- **Ascending Triangle:** Bullish continuation pattern with flat resistance and rising support,
- **Descending Triangle:** Bearish continuation pattern with flat support and falling resistance,
- **Symmetrical Triangle:** Neutral pattern; breakout may occur in either direction.

Triangles reflect a temporary balance between buyers and sellers, followed by a volatility expansion at breakout.

Triangles: Examples

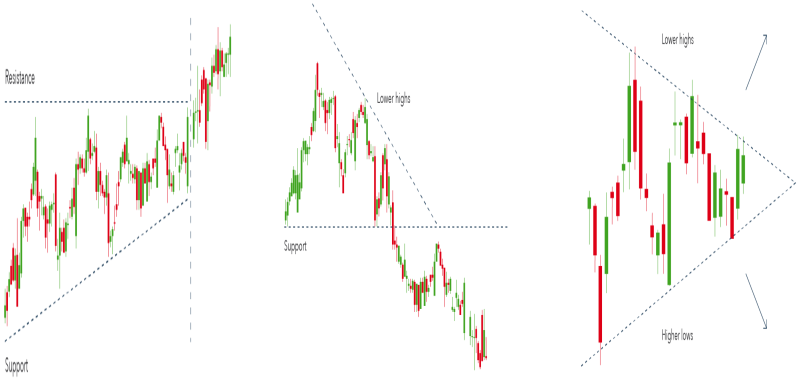

Figure 10: Ascending (left), Descending (middle), and Symmetrical (right) triangle patterns

Flags and Pennants

Flags and pennants are **continuation patterns** that represent brief pauses before the prevailing trend resumes.

Flags:

- Price consolidates within parallel support and resistance lines,
- Typically short-lived and often slope against the dominant trend,
- A breakout usually confirms continuation in the direction of the prior move.

Pennants:

- Small symmetrical triangles that form after sharp price movements,
- Reflect temporary consolidation with converging trendlines,
- Breakout generally follows the direction of the preceding trend.

Flag Continuation Patterns

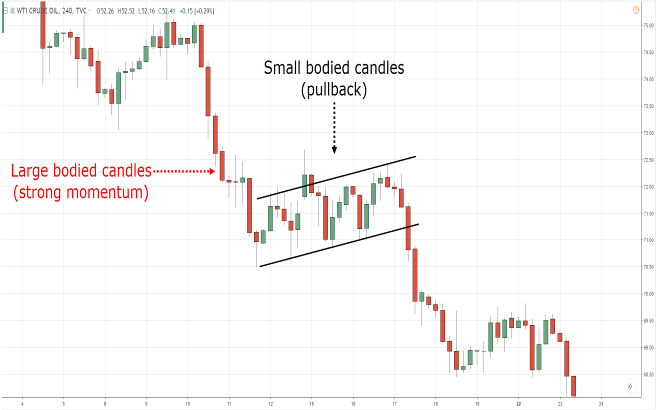

Figure 11: Flag continuation pattern

Pennant Continuation Patterns

Figure 12: Pennant continuation pattern

Channels Charting

A **price channel** forms when price oscillates between two parallel trendlines, capturing the dominant directional structure of the market.

Types of channels:

- **Horizontal:** Equal highs and equal lows (sideways market),
- **Ascending:** Higher highs and higher lows (*bullish channel*),
- **Descending:** Lower highs and lower lows (*bearish channel*).

Channel strength (number of confirmations):

- $[1, 2]$: weak channel,
- $[3, 4]$: adequate channel,
- $[5, 6]$: strong channel.

The end

Thank You !