NUS
INVESTMENT
SOCIETY

MOVING AVERAGE CONVERGENCE DIVERGENCE(MACD)

INTRODUCTION TO STOCHASTICS

INTRODUCTION

DEFINITION

- The **MACD** is a tool that helps traders **spot trends in a stock's price**. It compares two moving averages (usually 12-day and 26-day) to show momentum.

- The **Signal Line** smooths out these changes to **make it easier to identify when to buy or sell**. It's typically based on a 9-day average.

QUICK INTERPRETATION

- **Bullish Signal**: When the **MACD line crosses above the Signal Line** (9-period EMA), it suggests increasing momentum, indicating a potential buy opportunity.

- **Bearish Signal**: When the **MACD line crosses below the Signal Line**, it indicates weakening momentum, suggesting it might be a good time to sell.

- Typically, the **MACD line is shown in blue and the Signal Line in yellow** for easy distinction.
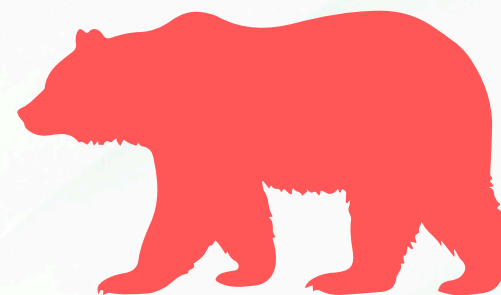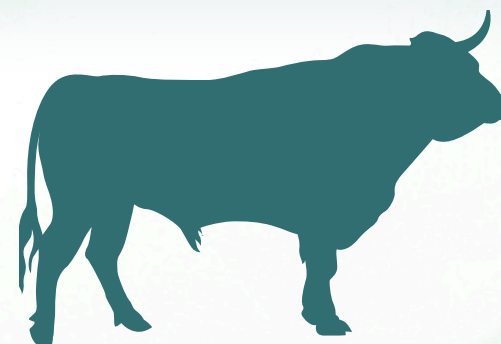
BASIC CASE STUDY

Basic MACD Cross Strategy

MACD FOR NVIDIA CORPORATION (SOURCE: TRADINGVIEW)

In the case of NVIDIA (Source: TradingView), the MACD highlights momentum shifts:

- A **BULLISH** SIGNAL OCCURS WHEN THE MACD CROSSES ABOVE THE SIGNAL LINE AFTER A BRIEF CORRECTION IN AN UPTREND, SUGGESTING THE TREND WILL CONTINUE.

- A **BEARISH** SIGNAL OCCURS WHEN THE MACD CROSSES BELOW THE SIGNAL LINE AFTER A BRIEF RISE, INDICATING LIKELY CONTINUATION OF THE DOWNTREND.

IN-DEPTH ANALYSIS

Mathematical Rationale for MACD

- MACD Line Calculation:
  - The MACD Line is the difference between the 12-period EMA (short-term trend) and the 26-period EMA (long-term trend).

- What is an Exponential Moving Average (EMA)?:
  - **EMA is a type of moving average that gives greater weight to recent prices**, making it more responsive to recent price movements compared to the Simple Moving Average (SMA), which assigns equal weight to all data points.

- EMA Formula:
  - **EMA(t) = Price(t) × k + EMA(y) × (1−k)**, where:
    - EMA(t): Current EMA
    - Price(t): Today's price
    - EMA(y): Previous day's EMA
    - k: Smoothing constant calculated as k=2N+1k=N+12
  - Examples of Smoothing Constant (k):
    - 7-period EMA: k=2/(7+1)=0.25
    - 21-period EMA: k=2/(21+1)=0.087

- Effect of Time Period on EMA:
  - **Shorter periods (e.g., 7-period EMA) place more emphasis on recent prices (25% weight).**
  - **Longer periods (e.g., 21-period EMA) are smoother and less responsive to recent price changes (8.7% weight).**

Mathematical Rationale for MACD

Derivation of MACD
- MACD Calculation:
  - MACD is the difference between the 12-period EMA (short-term trend) and the 26-period EMA (long-term trend).
  - This difference helps traders identify momentum changes in a stock or asset.

- How It Works:
  - The 12-period EMA reacts quickly to price changes, capturing short-term momentum.
  - The 26-period EMA moves slower, reflecting the long-term trend.
  - **Positive MACD (above zero): Short-term trend is stronger.**
  - **Negative MACD (below zero): Long-term trend is stronger.**

- Signal Line:
  - A 9-period EMA of the MACD line, used to filter out market noise.
  - We use the 9-period EMA as **it balances responsiveness and smoothness**, helping to identify buy/sell signals with fewer false positives.

Summary:
- The MACD compares short-term and long-term trends to indicate momentum shifts, while the 9-period Signal Line filters noise for clearer buy and sell signals. Together, they **help traders spot market turning points** and make informed decisions.

ADVANCED CASE STUDY

Advanced MACD Divergence Strategy

MACD FOR ALPHABET INC (SOURCE: TRADINGVIEW)

In the case of ALPHABET (Source: TradingView), the MACD highlights momentum shifts:

- **BEARISH DIVERGENCE**: **HIGHER HIGHS IN PRICE WITH LOWER HIGHS IN MACD** SUGGEST WEAKENING MOMENTUM, POTENTIALLY LEADING TO **SHORT POSITIONS** DUE TO A LIKELY DOWNWARD REVERSAL.

- **BULLISH DIVERGENCE**: **LOWER LOWS IN PRICE WITH HIGHER LOWS IN MACD** INDICATE WEAKENING SELLING PRESSURE, SIGNALING A POSSIBLE **LONG POSITION** FOR AN UPWARD REVERSAL.

CONCLUSION

- The MACD is a **powerful tool for identifying momentum shifts and trends**, offering clear buy and sell signals through its comparison of short-term and long-term EMAs.

- However, it comes with limitations, such as **lagging in fast-moving markets and the potential for false signals in choppy conditions**. While the MACD helps traders make more informed decisions, it is essential to **use it alongside other indicators to mitigate its drawbacks**, especially in trending or sideways markets.