

# Mathematical Trading Strategies | Assignment 4

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### Comprehensive Analysis of Keltner Channel Strategy Combined with Hammer Candlestick Pattern for HDFC Bank Stock (equity = "HDFCBANK.NS")

**Introduction:** This report presents a comprehensive analysis of the Keltner Channel strategy combined with the hammer candlestick pattern applied to HDFC Bank stock (equity = "HDFCBANK.NS"). The strategy aims to identify potential buying and selling opportunities based on price movements and the Keltner Channel indicator. The analysis covers the period from July 6, 2013, to July 6, 2023, and includes calculations of Keltner Channels, visualization of price data and indicators, evaluation of performance metrics, and a detailed interpretation of the strategy's effectiveness.

**Strategy Description:** The strategy combines the hammer candlestick pattern with the Keltner Channel to generate buy and sell signals. The hammer candlestick pattern is a single candlestick pattern indicating a potential price trend reversal. It consists of a small body near the top or bottom of a trend with a long lower wick. The Keltner Channel is a volatility-based technical indicator that helps identify price breakouts and overbought/oversold conditions. It consists of an exponential moving average (EMA) as the middle line, with upper and lower bands calculated by adding and subtracting a multiple of the Average True Range (ATR) from the EMA.

**Buy Signal:** To generate a buy signal using this strategy, we look for a hammer candlestick pattern near the lower band of the Keltner Channel. This suggests a potential oversold condition and a possible upward price reversal. We wait for confirmation by observing the subsequent candlesticks. If the price breaks above the high of the hammer candlestick, it can be considered a buy signal, indicating higher probability of an upward move in the price.

**Sell Signal:** To generate a sell signal, we look for a hammer candlestick pattern near the upper band of the Keltner Channel. This suggests a potential overbought condition and a possible downward price reversal. We wait for confirmation by observing the subsequent candlesticks. If the price breaks below the low of the hammer candlestick, it can be considered a sell signal, indicating higher probability of a downward move in the price.

**Visualization of Keltner Channels:** Two types of visualizations are employed to gain insights into the Keltner Channel behavior. Yearly Keltner Channel figures are plotted for each year within the specified period, showing the Keltner Channel, EMA, upper band, and lower band using matplotlib. Additionally, a combined plot of the Keltner Channel and the corresponding candlestick chart is generated for each year. This visualization showcases the price data, Keltner Channel lines, and highlights buy and sell signals based on the presence of hammer candlestick patterns.

**Performance Evaluation:** The strategy's performance is evaluated based on cumulative returns, maximum drawdowns, and Sharpe ratios derived from the buying and selling signals generated by the hammer candlestick pattern.

**Mean Cumulative Returns:** The strategy achieved a mean cumulative return of 1.58%, indicating profitable trading opportunities captured by the strategy over the analyzed period.

**Mean Maximum Drawdowns:** The mean maximum drawdowns were 0.0 or 0%, suggesting consistent performance and lower risk associated with the strategy.

**Mean Sharpe Ratio:** The mean Sharpe ratio calculated for the strategy was 0.5018, indicating a positive risk-adjusted return, though with a moderate magnitude.

**Conclusion:** Based on the analysis of the Keltner Channel strategy combined with the hammer candlestick pattern on HDFC Bank stock, the strategy demonstrated promising results. It captured profitable trading opportunities, as indicated by the average cumulative return of 1.58%. The strategy showed consistent performance with no significant maximum drawdowns, suggesting lower risk. Additionally, the positive mean Sharpe ratio of 0.5018 indicates a positive risk-adjusted return, although with a moderate magnitude. Overall, the combination of the Keltner Channel strategy with the hammer candlestick pattern proved effective in identifying potential buying and selling opportunities in HDFC Bank stock. Further analysis and testing can be conducted to validate the strategy's performance across different time periods and stocks to assess its robustness and applicability in various market conditions.