

# Mathematical Trading Strategies | Final Project

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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 provides a thorough analysis of the Keltner Channel strategy in conjunction with the hammer candlestick pattern applied to HDFC Bank stock (equity = "HDFCBANK.NS"). Based on price movement and the Keltner Channel indicator, the strategy seeks to identify potential purchasing and selling opportunities. The analysis spans from July 6, 2013, to July 6, 2023, and includes Keltner Channel calculations, visualization of price data and indicators, evaluation of performance metrics, and a detailed interpretation of the strategy's efficacy.

**Strategy Description:** This strategy generates buy and sell signals by combining the hammer candlestick pattern with the Keltner Channel. The hammer candlestick pattern is a solitary candlestick pattern that indicates a possible reversal in price trend. It comprises of a small body and a long lower wick near the top or bottom of a trend. The Keltner Channel is a volatility-based technical indicator that aids in the identification of price breakouts and overbought/oversold conditions. It consists of an exponential moving average (EMA) as the centre line, with upper and lower bands calculated by adding and subtracting multiples of the Average True Range (ATR) to the EMA, respectively.

**Buy Signal:** For this strategy to generate a buy signal, we watch for a hammer candlestick pattern near the lower Keltner Channel band. This indicates a possible exhausted condition and a possible price reversal to the upside. Observing subsequent candlesticks, we wait for confirmation. If the price breaks above the peak of the hammer candlestick, this may be interpreted as a purchase signal, indicating a greater likelihood of an upward price movement.

**Sell Signal:** To generate a sell signal, a hammer candlestick pattern near the upper Keltner Channel band is looked for. This indicates a possible overbought condition and a possible price reversal lower. Observing subsequent candlesticks, we wait for confirmation. If the price breaks below the low of the hammer candlestick, it can be interpreted as a sell signal, indicating an increased likelihood of a price decline.

**Visualization of Keltner Channels:** The visual representation of Keltner Channels: Two types of visualizations are used to acquire insight into the behaviour of the Keltner Channel. Using matplotlib, annual Keltner Channel data are plotted for each year within the specified period, displaying the Keltner Channel, EMA, upper band, and lower band. For each year, a combined depiction of the Keltner Channel and the corresponding candlestick chart is also generated. This chart displays price information, Keltner Channel lines, and buy and sell signals based on the presence of hammer candlestick patterns.

**Performance Evaluation:** The performance of the strategy is evaluated based on its cumulative returns, maximum drawdowns, and Sharpe ratios, which are derived from the purchasing and selling signals generated by the hammer candlestick pattern.

**Mean Cumulative Returns:** The strategy obtained a mean cumulative return of 1.58%, indicating that it capitalized on profitable trading opportunities during the examined period.

**Mean Maximum Drawdowns:** The average maximum drawdowns were 0%, indicating consistent performance and reduced risk associated with the strategy.

**Mean Sharpe Ratio:** The strategy's mean Sharpe ratio was 0.5018, indicating a positive risk-adjusted return, albeit of moderate magnitude.

**Conclusion:** Based on the analysis of the Keltner Channel strategy in conjunction with the hammer candlestick pattern applied to HDFC Bank stock, it was determined that the strategy produced promising results. It seized advantageous trading opportunities, as evidenced by its cumulative average return of 1.58 percent. The strategy's consistent performance and lack of substantial maximum drawdowns indicate a reduced risk. In addition, the positive mean Sharpe ratio of 0.5018 indicates a moderately positive risk-adjusted return. The combination of the Keltner Channel strategy and the hammer candlestick pattern was successful in identifying potential purchasing and selling opportunities in HDFC Bank stock. Further analysis and testing can be conducted to validate the performance of the strategy across various time periods and equities to evaluate its robustness and applicability in a variety of market conditions.