**Mathematical Trading Strategy**

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Analysis of Keltner Channel Strategy with Hammer Candlestick Pattern on HDFC Bank Stock

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 5, 2013, to July 5, 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-** I have combined the hammer candlestick pattern with the Keltner Channel to generate buy and sell signals.
* **Hammer Candlestick Pattern**: The hammer candlestick pattern is a single candlestick pattern that indicates a potential reversal in the price trend. It consists of a small body located near the top or bottom of a price trend, with a long lower wick. The lower wick should be at least twice the length of the body. When a hammer pattern occurs, it suggests that buyers have stepped in and are potentially pushing the price higher (for a bullish reversal) or lower (for a bearish reversal).
* **Keltner Channel**: The Keltner Channel is a volatility-based technical indicator that helps identify potential price breakouts and overbought/oversold conditions. It consists of three lines: the middle line, which is an exponential moving average (EMA), and an upper band and a lower band, which are 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 that is formed near the lower band of the Keltner Channel. This suggests that the price has potentially reached an oversold condition and could reverse to the upside. We wait for confirmation by observing the price action in the subsequent candlesticks. If the price breaks above the high of the hammer candlestick, it can be considered a buy signal. This indicates that the buyers have taken control and there is a higher probability of an upward move in the price.
* **Sell Signal**: To generate a sell signal, we look for a hammer candlestick pattern formed near the upper band of the Keltner Channel. This suggests that the price has potentially reached an overbought condition and could reverse to the downside. We wait for confirmation by observing the price action in the subsequent candlesticks. If the price breaks below the low of the hammer candlestick, it can be considered a sell signal. This indicates that the sellers have taken control and there is a 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 behaviour:
* **Yearly Keltner Channel Figures**: For each year within the specified period, matplotlib is used to plot the Keltner Channel, EMA, upper band, and lower band. This provides a detailed visual representation of how the indicator evolves throughout different years.
* **Keltner Channel with Candlestick Chart:** For each year, a combined plot of the Keltner Channel and the corresponding candlestick chart is generated. 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 the cumulative returns, maximum drawdowns, and Sharpe ratios derived from the buying and selling signals generated by the hammer candlestick pattern.

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| **Mean Cumulative Returns** | **Mean Max Drawdowns** | **Mean Sharpe ratio** |
| 1.58% | 0.00 | 0.5018 |

* **Mean Cumulative Returns**: The strategy achieved a mean cumulative return of 0.0158 or 1.58%. This indicates that, on average, the strategy resulted in a positive return of 1.58% over the analysed period. The positive cumulative returns imply that the strategy was able to capture profitable trading opportunities.
* **Mean Maximum Drawdowns**: The mean maximum drawdowns were 0.0 or 0%. This suggests that, on average, there were no significant drops in the portfolio value from the previous peak. The absence of drawdowns indicates a consistent performance and suggests a lower level of risk associated with the strategy.
* **Mean Sharpe Ratio**: The mean Sharpe ratio calculated for the strategy was 0.5018. The Sharpe ratio measures the risk-adjusted return and reflects the excess return generated per unit of risk. A value greater than zero indicates a positive risk-adjusted return. The mean Sharpe ratio of 0.5018 suggests that, on average, the strategy generated a positive risk-adjusted return, though the magnitude is relatively moderate.
* **Conclusion:** Based on the analysis of the Keltner Channel strategy combined with the hammer candlestick pattern on HDFC Bank stock, the following conclusions can be drawn:
* The strategy demonstrated promising results, with an average cumulative return of 1.58%, indicating profitable trading opportunities captured by the strategy. Additionally, the absence of maximum drawdowns suggests a consistent performance and lower risk associated with the strategy. The positive mean Sharpe ratio further indicates a positive risk-adjusted return, though with moderate magnitude.