Executive Summary:

The research question is “Can Linear Regression Analysis of Bitcoin Time Series Price Data on Fractal Time Frames be used for Trade Optimization?”. The project will consist of running linear regressions on fractal time frames of Bitcoin’s publicly available price data. The intent is to produce a trading strategy that consists of comparing the linear regression slopes of these fractal time frames as an indicator to enter a trade

The Null Hypothesis is that running the linear regression analysis on Bitcoin’s price data over fractal time frames will not serve as an indicator to enter a trade long, and will have no influence on profits and losses due to trading activity. The Alternate Hypothesis is that running the linear regression analysis on Bitcoin’s price data over fractal time frames will serve as a reliable indicator to enter a trade long, and that this success as an indicator to enter the market long will result in increased profits and minimized losses due to trading activity.

The main technique utilized in this analysis is linear regression, specifically the calculation of the slope of price data with the intent of using the direction and magnitude of the slope to forecast future price movement. The justification for this is that the slope of the line represents the signal of price data, while eliminating the noise that is not relevant to the trader. A trade will be defined as a long entry (buying Bitcoin) of one BTC into the market at Tuesday 12:00 am and closing the trade (selling Bitcoin) at Friday 12:00 am.

Every Tuesday at 12:00 am, linear regression will be run on the three historical fractal time frames (1-day, 5-day, 25-day), and the slope of the regression lines will be calculated and compared. A positive trade signal will be defined as two or more neighboring fractal time frames having a linear regression with a positive slope, indicating a positive trend in the market. A negative trade signal will be defined as two or more neighboring fractal time frames having a linear regression with a negative slope, indicating either a negative or neutral trend in the market.

The control group will represent the trader following the null hypothesis, and ignore the linear regression indicators. They will place trades every Tuesday morning, resulting in 52 total trades. The experimental group will represent the trader following the alternative hypothesis. If the linear regression indicators show a trade should be placed, only then will they place a trade Tuesday morning, resulting in 52 - weeks skipped total trades. The results of the data analysis do not provide evidence to reject the null hypothesis. The control account made a profit of $9,870.04, while the experiment account made a profit of $4,140.86.

One limitation of this analysis is the strict time frames used for the trade entry and exit of three days. This strict entry and exit is required to standardize the trades across the control and experimental group, but is not how a trader would actually manage their position. As position management is outside the scope of this analysis, this limitation is accepted as part of the experimental design.

The recommended course of action is the use of linear regression of fractal time series analysis as a trade exit signal. This analysis has demonstrated the effectiveness of the indicator to enter trades, but further research could be done on the viability of using the negative of the indicator as a sign to exit the trade. Essentially, the analysis would be done in reverse. If the indicator proved to be as effective when done in reverse, this would add value to the overall trading algorithm by both signaling the entrance and the exit of a trade, thus encompassing the entirety of the trade instead of just the initiation. Additionally, it is recommended to incorporate best practice features into the automated trading algorithm that are tangential to the trading methodology itself. Features like risk control, automated stop loss calculation, and initiation of trades via API call are some of the features to be added in future iterations of the program.

The expected benefit of the study is the definition and optimization of a trading methodology that results in a positive equity curve over time. The intent of the analysis is to produce a trading strategy that consists of comparing the linear regression slopes of these fractal time frames as an indicator to enter a trade. The comparison of the linear regression slopes will help determine the overall trend of the market, and if the fractal time frames indicate the market is bullish, then a trade long will be executed. The trade is initiated with the intent of closing the trade at a later date for a higher market price, resulting in a profit, which is calculated at the future price minus the current price. Another expected benefit of the study is the standardization of trade entry indicators. Rather than a trader saying to themselves that the trade subjectively “feels right” or “looks good”, the quantification of a trading entry indicator via linear regression analysis allows the trader to calculate probabilities of success of the trading methodology over multiple trading iterations. This can only be done with a clearly defined methodology and indicator, because a trader’s emotional state is not a defined market setup.

Panopto Link:
https://wgu.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=639499d6-f5dd-4e5f-8b51-b11b00fc9c6f