

Report

Mean Reversion

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Mean Reversion



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STOCK MARKET

Stocks, also known as shares or equities, represent company ownership. When a business needs to raise capital, it can do so by selling shares to the public. Investors who acquire these shares are entitled to a portion of the company's profits and assets.

Investing in stocks has the potential to increase wealth over time. The value of a stock can increase as a company grows and becomes more profitable, allowing investors to make a profit by selling their shares for more than they paid. Additionally, some stocks pay dividends, which are regular distributions of a portion of the company's profits to shareholders.

Nonetheless, the value of stocks can decline, resulting in investor losses. This can occur for a variety of reasons, including a decline in the company's financial performance or negative industry-related news.

There are numerous ways to invest in stocks, including purchasing individual stocks or mutual funds or exchange-traded funds (ETFs) that hold a basket of stocks. Before investing, it is essential to conduct research and understand the risks associated with each method.

Fundamental analysis is one method for researching stocks; it involves analyzing a company's financial statements, management team, industry trends, and other factors that can affect the company's performance. Technical analysis is another method for researching stocks; it involves analyzing past stock prices and market trends to identify potential buying and selling opportunities.

Investing in stocks entails risks and requires research and consideration. It is essential to have a diversified portfolio that balances risk and return in accordance with your personal financial goals and risk tolerance. Additionally, it is essential to regularly monitor your investments and make necessary adjustments based on market fluctuations and your personal financial situation.

The amount of money that circulates on the stock market can vary significantly based on a variety of factors, such as market conditions, investor sentiment, and broader economic trends.

The estimated total market capitalization of all publicly traded companies worldwide as of March 2023 is approximately \$94 trillion. However, this number fluctuates constantly due to fluctuations in stock prices and the number of outstanding shares for each company.

Not all this capital is actively traded every day, as many investors hold their stocks for the long term. Moreover, the amount of money that individual investors have invested in the stock market can vary significantly based on their individual financial situations and investment strategies.

MEAN REVERSION

Mean Reversion is a popular investment strategy that entails purchasing assets that have underperformed recently with the expectation that they will eventually revert to their mean or average performance. In this report, the potential benefits and drawbacks of the Mean Reversion investment strategy will be examined, as well as compared to other prevalent investment strategies.

Pros:

- **Good return potential:** If the assets you invest in do revert to their mean value, you could earn a good return on your investment. This is due to the fact that assets that have underperformed recently are frequently undervalued by the market, and if they return to their historical average performance, they may generate significant returns for investors.
- **Low correlation with other strategies:** Due to its low correlation with other investment strategies, such as trend-following, the Mean Reversion strategy can be a useful complement to them. This indicates that the addition of Mean Reversion investments to a diversified portfolio can help reduce overall risk and volatility.

The Mean Reversion strategy is frequently based on fundamental analysis of the assets being invested in, which can assist investors in making informed decisions. By analyzing a company's financial health, industry trends, and market conditions, investors can more accurately determine whether an asset is likely to revert to its mean performance over time.

Cons:

- **Uncertainty and risk on downtrends:** All investment strategies involve uncertainty and risk, and the Mean Reversion strategy is no exception. No assurance exists that assets will revert to their mean or that returns will be high. In fact, some assets may continue to underperform, resulting in investor losses.
- **Potential for inefficiency:** It can be difficult to read the market and purchase assets at the optimal time, particularly if the market is unstable. The Mean Reversion strategy requires a thorough evaluation of market conditions and asset performance.

The Mean Reversion strategy requires discipline and patience, as assets may take time to revert to their mean value. Investors must be willing to retain assets even if they continue to underperform in the short term if they believe the assets have long-term potential.

Compared to other approaches:

- **Trend-following strategy:** This strategy entails purchasing assets that have recently performed well in the hope that they will continue to perform well. The Mean Reversion strategy is essentially the inverse of this, as it entails purchasing assets that have recently underperformed. While both strategies aim to generate good returns, they identify assets with potential in different ways.

The Trend-Following Strategy involves purchasing assets and holding on to them for the long term, regardless of short-term price fluctuations. The Mean Reversion strategy is more focused on the purchase and sale of assets based on their recent performance. While both strategies aim to generate good returns, their time horizons and risk management approaches are distinct.

The Mean Reversion Strategy entails purchasing assets that are undervalued by the market with the expectation that they will eventually be priced more accurately. It can be viewed as a form of value investing because it entails purchasing assets that are currently underperforming but may have long-term potential. Most Mean Reversion strategies focus more on price fluctuations, whereas value investing takes a longer-term approach to identifying undervalued assets.

Mean Reversion is a potentially dangerous and addictive tool for investors seeking good returns and low correlation with other investment strategies. However, it requires thorough market research to be considered a valuable strategy.

BUILDING THE STRATEGY

The first step in developing the strategy was calculating the ratio between the closing price of a stock and its moving average for a fixed number of days. In the case of the algorithm developed, a moving average of 5 days was used.

$$\text{Ratio} = \frac{\text{Share Price}}{\text{Moving Average}}$$

The output of this function will return a value greater than zero, where a value less than one indicates that the share price is lower than the moving average, and a value greater than one indicates an evaluation greater than the moving average. In the context of the strategy being implemented, a value lower than one indicates a possible under-extension of the share price, creating profit opportunity.

To implement the Mean Reversion Strategy, a method was developed to create indicators of when to buy and when to sell shares present in the portfolio. To do so, on a given day, the mean ratio was calculated given the ratios of the past 30 days (indicated by the yellow line on the graph below). The green and red lines represent the 1st and 99th percentile of the set of ratios, respectively. Whenever the daily ratio, as calculated above, was lower than the 1st percentile, this was taken as an opportunity to buy a share. Similarly, whenever the ratio appeared above the 99th percentile, a sell order was put in place.

The graph below represents the ratios, average ratios, and ratio percentiles for Norwegian Cruise Line Holdings Ltd with the ratio averages calculated using the last 30 days in the past one year to date.

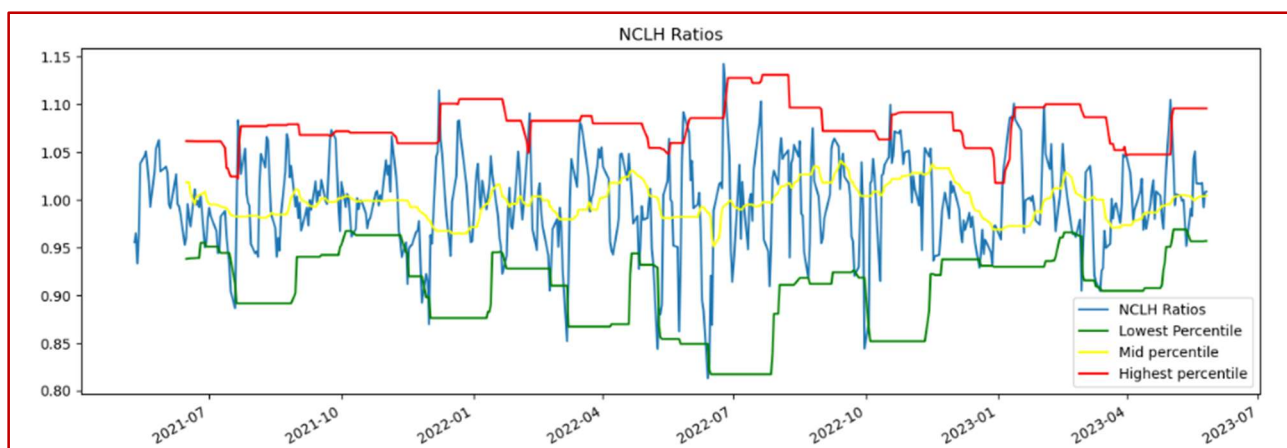


Figure 1 - Plot of the ratios over the timeframe

The average ratio was calculated using the past 30 days, as this was the value that presented the highest return rates given a series of automatic tests when implementing the Mean Reversion Strategy.

In the presence of each buy trigger, a base amount of money was invested each time. In the presence of several of these triggers in a row, each subsequent buy trigger would have an additional 500% of this fixed amount invested, repeating this process until in the presence of a sell trigger, in which case, all the shares in the portfolio were sold at the closing price of that day. To give an example:

An indicator to buy was generated on the 1st, 2nd, and 3rd of May, and an indicator to sell was generated on the 4th. On the 1st, 5\$ worth of the stock were bought, on the second day, an additional 30\$ were bought,

and on the 3rd day, 180 \$ would be invested. On the fourth, all the shares that were bought with this would be sold.

The rationale behind this decision was that, whenever a series of buy triggers were generated in a row, it was common for each subsequent trigger to be at a lower price than the previous, hence allowing for a higher return on investment.

The following plot is a visualization of the triggers generated using the aforementioned algorithm, following the price of Norwegian Cruise Line Holdings Ltd.

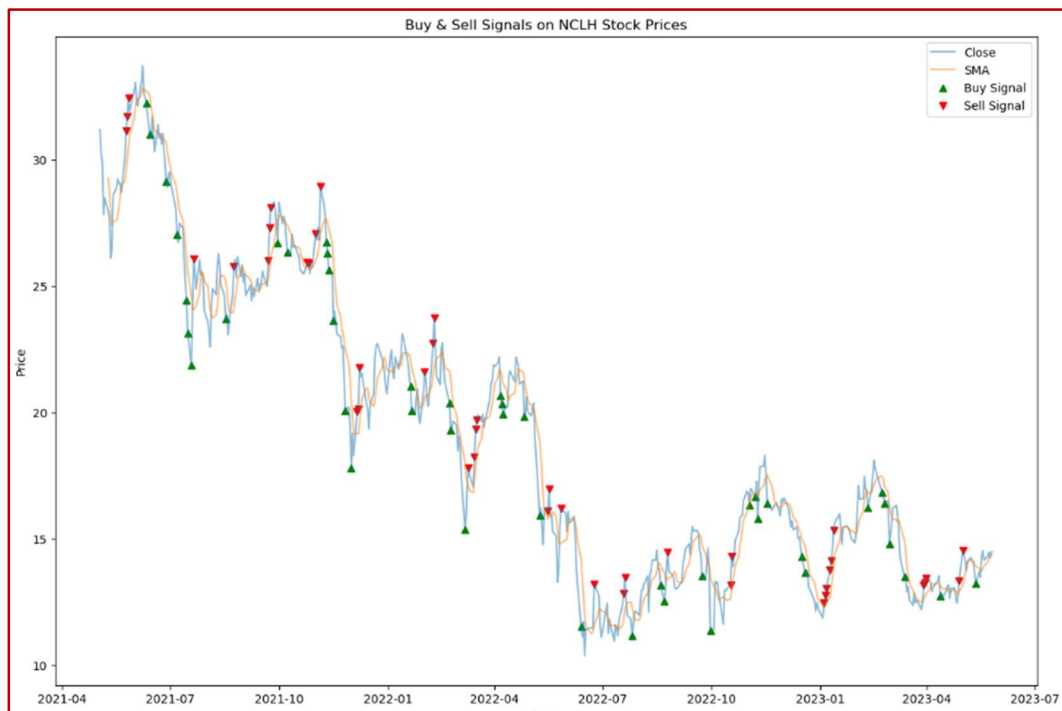


Figure 2 - Buy Signals for NCLH

One of the most prominent cases where there is a loss of profitability in the implementation of this strategy is during a market downtrend. This is because triggers to buy appear at higher prices than the next triggers to sell. This is where the multiplicative investment method in the presence of multiple consecutive buy triggers benefits this strategy, as relatively less money is invested at the beginning of these downtrends, mitigating the investment loss or even creating positive returns for the investment.

In figure 2 we can see the problem that has been mentioned and this stock was chosen because it is especially favorable to emphasize exactly that, however it is still possible to obtain positive returns due to the multiplicative investment method.

TESTING THE STRATEGY

Taking into account the above analyses, the strategy must be tested. Towards this goal, the top 5 stocks with the highest Beta measure values out of the S&P 500 were selected, in an attempt to identify higher volatility stocks.

Beta, which is the ratio between the covariance of a stock in relation to the market, and the variance of the stock itself, heavily influences the performance of this strategy. Stocks with a higher beta tend to experience mean reversions more often, due to having larger and more frequent changes in price over the same periods of time compared to the overall market. This allows the Mean Reversion strategy to trigger more frequently and possibly result in higher returns during these time frames.

$$\text{Beta } (\beta) = \frac{\text{Covariance}}{\text{Variance}}$$

Below are the returns, in the past one year to date using the Mean Reversion Strategy, as well as the Buy and Hold returns. For presentation purposes, only the top 5 stocks with the highest beta included in the S&P 500 were included in the table.

Stock	Mean Reversion Return %	Number Trades	W/R %	Buy & Hold %
CCL	30.998%	9	88.89	-59.2%
NVIDIA	13.1531%	9	88.89%	162.0%
NCLH	18.063%	9	77.78%	-53.8%
GNRC	5.13915%	8	75.0%	-64.9%
AMD	24.55217%	9	88.89%	61.0%

Table 1 - Results of the Strategy

As can be seen, given a stock with a high beta index, a positive return was always guaranteed on top 5, with the average return for these five stocks coming out to 18.38%. When tested with the top 10 stocks with the highest beta, 9 out of the 10 generated positive returns, the only one creating a loss being the Tesla stock (TSLA), with a return of -1.35%.

CONCLUSION

Of the most commonly traded financial assets, Mean Reversion works best for stocks rather than other, more trend-following instruments. Given a high-volatility stock, with an elevated beta index, there are more opportunities for Mean Reversion due to over and under extension in price, hence generating a greater profit than when used with less volatile stocks.

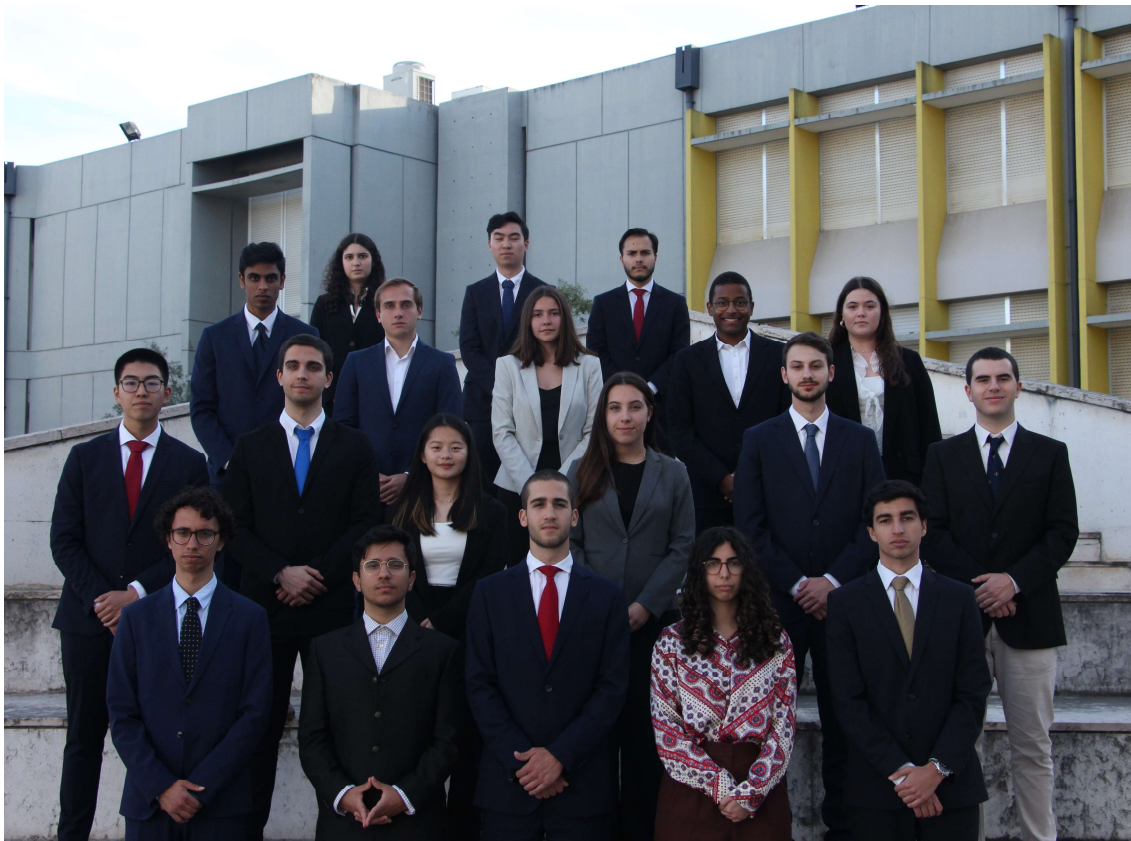
Given a stock with a high-value beta, it can be said that the Mean Reversion Strategy implemented doesn't guarantee high returns on investment, but following the tests that were performed, almost always gives a positive return, concluding that it is a relatively low-risk strategy.

Albeit a low-risk strategy, there is no guarantee that the strategy will hold up given a different economic climate, as is the case with any investment strategy, however this strategy can be a great right arm for the investor in various situations.

With that being said, the algorithms implemented have lots of potential for growth, like being able to recognize downtrends to avoid premature purchases, or better indicating the most profitable selling point.

OUR TEAM

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