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Pair Trading Strategy

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Introduction

Pairs Trading is a simple strategy that is easily understood and implemented in financial trading. This strategy came into fore in the 1980s as a result of financial analysts exploring opportunities to better harness observed trends in the performance of stocks in similar sectors. Following an increase in computing power across the years as well as increasing availability and accessibility to troves of financial data, this strategy has witnessed increasing adoption. A key advantage of the pairs trading strategy is its inferability as compared with advanced techniques such as Artificial Neural Network which utilize advanced mathematics to develop algorithms for algorithm trading. As such, it's the first point of contact in attempting to develop a well performing algorithmic trading strategy. Pairs Trading can be implemented in Excel, R, or Python. These are tools that are familiar with financial analysts. Important concepts in developing a well-performing pairs trading strategy include a thorough understanding of correlation, cointegration, backtesting, and proper performance analysis of developed models.

Origin of Pairs Trading

Pairs trading is a popular investment trading strategy dated back to the 1980s and has been adopted by organizations since then. It was created when the first quants in wall street were looking for principles based on statistics that can be used to take advantage of short-run differences in the prices of two assets with similar characteristics that have had consistent long-run equilibrium overtime. Specifically, pairs trading was first developed by the employees of popular American Investment bank, Morgan Stanley, in the mid-1980s. Headed by Nunzio Tartaglia, the team developed pairs trade as an automated trading system to detect and make use of pricing discrepancies in financial markets, and it turned out to be one profitable strategy. With members of the team gradually spreading to other firms, so did the knowledge of pairs trading, and it has then been a widely used and highly researched trading strategy.

Basically, pairs trading works by matching an asset having a long position with another asset having a short position bearing in mind that both assets have a high correlation. When this principle of correlation is in place over a period of time and a correlation discrepancy is noticed, the pairs trade can be deployed. When this discrepancy comes into play, the pairs trader would purchase the asset matched in the long position when it underperforms and then sells the asset matched in the short position when it outperforms. The trader then makes his profit afterward when the prices converge. Therefore, pairs trading can be seen as both a hedging and speculation instrument nevertheless, it has its own limitations.

Requirements for the implementation of Pairs Trading

Two important requirements for pairs trade are:

1. Historical correlation
2. Cointegration

Thus, investors have an eye for both to find a suitable pair to trade.

Correlation

Correlation is measured by the coefficient ρ, which ranges from -1 to +1. The correlation coefficient indicates the degree of connection between two variables, in our case, between stock prices. The extreme value of +1 means there is a perfect positive correlation between stocks, and -1 means there is a perfect negative correlation. Zero means there's no relationship between the compared stocks. A perfect positive correlation is when one variable move in either up or down direction, the other variable also moves in the same direction with the same magnitude while a perfect negative correlation is when one variable move in the upward direction, the other variable moves in the downward (i.e. opposite) direction with the same magnitude.

The correlation coefficient for two variables is given by;

Correlation (A, B) = ρ = COV(A, B) / SD(A).SD(B)

Where, Cov (A, B) is the covariance between A & B while SD(A) and SD(B) denotes their respective standard deviations.

If the correlation is high, say 0.8, traders may choose that pair for pairs trading. This high number represents a strong relationship between the two stocks. So, if A goes up, the chances of B going up are also quite high. Based on this assumption a market-neutral strategy is played where A is bought and B is sold; bought and sold decisions are made based on their individual patterns.

Cointegration

Cointegration, on the other hand, talks about how constant the distance between the two assets is in price over time. If A and B are cointegrated then it implies that an equation connecting them is stationary. A stationary process has very valuable features that are required to model Pairs Trading strategies. For instance, if the connecting equation between A and B is stationary, it indicates that their mean and variance remain constant over time. So, if we start with a hedge ratio, so that spread equals 0, the property of stationary implies that the expected value of spread will remain as 0. Any deviation from this expected value is a case for statistical abnormality, hence a case for pairs trading.

For the implementation, it's good to note that stocks from the same sector and stocks that are direct competitors to one another are heavily correlated oftentimes and consequently great candidates for pairs trading. Here, a long position is paired with a short position of two highly correlated (or cointegrated) stocks. There are many reasons for taking either of such positions. The position can be market neutral. That is to say, you can establish a position that seeks to make money regardless of the performance of the broader market. In such a trade, as long as the length goes up more than the short goes up or the short goes down more than the long goes down, it is a profitable trade. A situation that is known as "Hedging" in Finance.

As often noted in literature, the challenges to implementing pairs trading seem to hover around choosing a pair which will give good statistical arbitrage opportunities over time and the decision of when to trade/exit points.

Execution cycle for Algorithmic trading

1. Development of selection criteria: It is the most rigorous aspect of pair trading. It involves having a pool of trading parameters, establishing and testing models, validating a suitable model, and creating appropriate trading rules.
2. Obtain candidate trades that meet up with selection criteria: After the selection criteria have been established, the trader will create a list of possible participants that can trade. This can be done through manual research or modeling. A major factor to consider in doing this is the relationship between the holding position and frequency of trading. The relationship is found to be inversely proportional i.e. The longer the positional holding period, the lesser the frequency of participant trade required
3. Evaluation of technical, mathematical, and statistical analysis: Proper analysis should be done in order to establish appropriate guidelines for the grade. This will go a long way in reducing the probability of losses and also help to achieve predetermined trading objectives. Examples of such analysis are Candlestick charting and Relative strength
4. Trade execution: As a rule of thumb, the short side of a trade should be executed first and filled before the long position is taken. Trading can be done either manually or with computer programs built with algorithms. Algorithmic trading programs are widely used due to convenience, accuracy, speed, and other relevant benefits.
5. Trade management: The trader is saddled with the responsibility of managing the trade not just based on predetermined rules but also based on changing market conditions. News and published reports about parameters involved in the trade must be observed keenly by the trader. Information regarding price of assets must be used to adjust the risk/return position adopted in the trade. If a trade performed well beyond expectation, the trader might decide to close the trade if the risk doesn't guarantee maximum reward, and the trader can choose to reinvest in the same trade if market conditions are estimated as favorable.
6. Trade closure: This is the last step involved in algorithmic trading and it requires the trader to be compliant and disciplined. If a trader becomes greedy, he might want to extend the trading period in the hope that more profit can be earned. This is usually risky therefore, it is expected that traders do their businesses with integrity, strict adherence to laid down rules, and with zero conflict of interest.

Applications of Pair Trading

1. Forecasting: Prior to doing this, the required portfolio is constructed such that the spread series denotes a stationary process. After this is done, methods used in time series analysis are used to formulate a model that can be used to find cointegration abnormalities between two assets that generally show stationary correlation. The abnormality is hoped to correct itself soon and then forecasts are made on the contrary direction of the abnormality.
2. Hedging: Pairs trading help to hedge sector and market risk because, since both assets used in the trade are positively correlated, if the entire market follows a downward trend, the trade would result in a profit and loss that would cancel out.
3. Self-funding: Since pairs trading involves both long and short positions, the proceeds obtained from the short sales can be reinvested to generate a better long position. Proceeds in the form of profit are obtained when the market trend moves as expected by the trader who trades from a speculative perspective. Arbitrage opportunities can also be beneficial when observed and taken advantage of amongst assets that show significant levels of correlation with each other.

Limitations of Pair Trading

1. Correlation Value: Pair Trading is best implemented between two assets having a very high correlation value. It is recommended that the correlation value be as high as 0.8 but this can be difficult to obtain in the market due to market parameters which vary easily.
2. Historical reliance on data: It has been proven overtime that past prices are not always indicative of future trends. Just because two stocks were historically correlated doesn't guarantee future correlation and it is very difficult to spot loopholes in a correlation model.
3. Fees and Commissions: Due to the nature of the trade which sometimes involves difference in commission to be equal in value to difference between profit and loss, a lot of pair traders are usually involved in large trading volumes which requires more capital as margin requirement and this in turn increases risk.

Improvement tips for algorithmic trading

1. Making informed adjustments: Using highly correlated stocks as an example, if the price of the stocks does not revert back to their expected mean position, it is advisable to shift your trade bias at an intraday level to a more long or more short position in order to take advantage of the latest market trend. It is also

advisable to watch out for cointegration and not just correlation because pair stocks could have a divergent trend over long periods and still appear to be correlated.

2. Opening pairs aftershock: Trading volumes can be used to monitor the demand of assets and can, in turn, be used to identify irregular changes that can affect the relationship between the assets that make up the pair. According to Engelberg, Gao, and Jagannathan (2009), it's expected that if a common shock exists then a volume increase will occur in both assets and if that shock only affects one of the assets then the volume increase will be confined to an increase in the volume of the respective asset. This principle can be incorporated in making good judgments when determining the trading volume to adopt for a pairs trade.

Conclusion

This algorithmic strategy can be easily implemented. Upon a thorough understanding of correlation and cointegration, a suitable pair of stocks can be selected and a strategy developed. Additional care should be paid to the differences between a hypothetical and real-life model. This can be incorporated by taking into account features such as transaction costs.

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