



Shri Chimanbhai Patel Institutes, Ahmadabad

The Case of Gold and Silver: A New Algorithm for Pairs Trading

**Jay Desai
Arti Trivedi
Nisarg Joshi**

Abstract

In this paper we propose a new algorithm for pairs trading. Pairs Trading is a very popular trading strategy also known as market neutral position. The basic idea is to create a long/short position with securities that move together. Securities having strong co-relation (We propose correlation greater than 0.90) can be traded by using the proposed method in this paper. The basic concept of stochastic is applied to find the entry and exit points of a trade. The algorithm is tested on gold and silver prices for market neutral position. From a researcher's point of view as per Efficient Market Hypothesis theory, pairs trading strategy should not result in positive returns as the past behavior of a stock price reflects the information flow of past. And has no effect on the future prices. The main objective of this research is to propose a simple method of pairs trading useful to market practitioners and researchers. The proposed algorithm generated 100% accurate trades with return of 44.45% for the test period.

Author Contact : jay@jaydesai.net
arti@artitrivedi.com
nisarg@nisargjoshi.com

1. Introduction

“Just like a drunk man leaving a bar follows a random walk. His dog also follows a random walk on its own. The path will diverge.....Then they go in to a park where dogs are not allowed to be untied. Therefore the drunken man puts a strap on his dog and both enter in to the park. Now they share common direction, their paths are co-integrated.”²⁴

The Efficient Market Hypothesis clearly states that on its weak form the past trading information of a security is reflected by its price, and that the past trading history of a security has no potential for predicting future behavior. The major conclusion of this theory is that no logical rules of trading based on the historical data will generate excessive return over a benchmark.

Opposite of EMH, several papers have shown that past information helps, to a certain extent, explain future stock market returns. Such predictability can occur in from seasonality (day of the month effect¹) and correlation between the asset's return and other variables². More detailed information on efficient markets can be found in literature^{3, 4}.

Many papers have tried to use quantitative trading rules in order to model the market. The purpose of such research is to find patterns in the historical price behavior and, using only historical information in to account for creating trading strategies.

One of the most common and popular method of market modeling is technical analysis⁵. Technical analysis is based on quantitative methods (moving averages and others) and also visual patterns (head and shoulders, wedge, triangle to name a few) in order to identify entry and exit points on the short and long term behavior of security prices. The popularity of technical analysis, lead a number of researchers to verify if such tools and methods were profitable or not? We would like to mention here that majority of researchers confirmed that technical analysis is profitable but several issues remain unaddressed like data snooping, transactions costs etc. All these issues still make technical analysis a subject to be studied⁶.

With availability of computers in late 90s, more sophisticated mathematical models could be employed for the purpose of developing and testing trading rules. One classic example is of nearest neighbor algorithm in trading strategies^{7, 8, 9, 10}. The Artificial Neural Network algorithm is a non parametric method of modeling time series that has an intuitive appealing based on chaos theory and has capability to understand hidden pattern in a time series that can be used for forecating¹¹. The main finding of the results presented on the predictability potential of ANN is that it is able to predict correct market direction for most of the forecasted financial observations.

For trading strategies based on parametric models^{12, 13}. The referenced papers are based on the regime switching models; the results here indicated that it is possible to predict the time series. Other types of strategies are based on quantitative formulations including timing the market with fundamentals or statistical models^{14, 15} and momentum strategies^{16, 17, 18, 19}. The results from all these research demonstrate positive results.

Pairs Trading became very popular from 1980s. The methodology was developed by a team of scientists from different areas like mathematics, physics, computer science etc. The team was created by wall-street quantitative trader Nunzio Tartaglia. The main task of the team was to develop computer based statistical methods, where the human subjectivity had no influence in the process of making the decision of buy or sell in securities trading. The system was successful for some time, but the performance lacked consistency. More detailed explanations on pairs trading can be found in work of Vidyamurthy²⁰ and Gatev²¹.

The basic idea of pairs trading is to take advantage of market inefficiencies. The first step is to identify two securities that move together and exploit the opportunity every time the absolute distance between the price paths is above a particular threshold value. If the security, after the divergence, return to the historical behavior of symmetry, then it is expected that the one with abnormal price rise will decrease and the one that has lagged behind the price will rise. All the positions in a market neutral strategy is taken with this logic, the specific details about choosing pairs and a novel method to identify the threshold point of entering a trade and exiting a trade are the scope of this paper.

The main objective of this paper is to investigate the profitability and risks of pairs trading strategy for Gold and Silver. Pairs trading have been profitable in the past studies^{21,22}. Not much literature is available in India on Gold-Silver Pairs trading. Also the methodology explained in this paper is easy to understand and implementable. Also it does not require complex statistical formulas to identify trading opportunities. We have developed the methodology specifically by using a simple computer based spreadsheet.

2. Methodology

The methodology used in this paper is mainly concerned with three major points 1) Identifying two securities for pairs trading, 2) How to trigger a long/short market neutral position and 3) Performance measurement

2.1 Pairs Selection

To find pairs that can be traded for a market neutral strategy, we propose to use correlation test. Two securities having correlation greater than 0.90 can be tested for pairs trading, we also recommend a back testing of the pair to identify the profit potential and risk measurement.

Correlation can be tested as formula [1].

$$r = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{(n \sum x^2 - (\sum x)^2)(n \sum y^2 - (\sum y)^2)}} \quad [1]$$

In case of this paper we are only considering Gold-Silver for pairs trading.

Another method to find suitable pair, is conducting Dickey-Fuller Test as suggested by Herlemont²³. We are only considering correlation test for this paper.

2.2 Defining entry and exit points for trade

The algorithm we propose to define entry and exit points of a market neutral strategy is as follows.

If daily closing price of two securities is C_1 and C_2 than

$$\text{Average } A = (C_1 + C_2) / 2 \quad [2]$$

$$\Delta_1 = C_1 / A \quad [3]$$

$$\Delta_2 = C_2 / A \quad [4]$$

The ratio of Δ

$$\Delta = (\Delta_1 / \Delta_2) \quad [5]$$

$$\theta = \text{Percentrank}(\Delta, \text{Period}(N)) \quad [6]$$

Here, the period N can be decided based on back testing results or a traders comfort with number of trades.

Trading Rules:

If (percentrank > 0.90, create market neutral position)

If (Percentrank < 0.10, close market neutral position)

The thumb rule in the algorithm is when two highly correlated securities move away from their mean and distance reaches the highest 10% compared to last N number of days a long/short market neutral position is created and when the distance reaches the minimum 10%, the position is closed. For this paper we are taking $N=200$ days

2.3 Performance

The performance of the algorithm is tested on two counts 1.Number of successful trades and 2. Return generated by trades

3. Data

This study encompasses over trading days from 1st January, 2004 to 30th June, 2012. The Closing price of gold and silver on MCX, India is considered.

1. Closing prices from 1st January, 2004 to 31st December, 2007 is studied for correlation test.
2. Closing prices from 1st January, 2008 to 30th June, 2012 is tested with the proposed algorithm.

4. Results

1. The correlation between the gold and silver prices for the period was found to be **0.9640**, which is greater than 0.90 and therefore gold/silver qualifies for pairs trading as per proposed rule.
2. The algorithm triggered three positions during the test period.
3. All positions generated positive returns with **100%** accuracy.
4. The positions delivered returns of **44.45%**, with average positional profit of **14.82%**.
5. Silver delivered positive return in all three positions, where as gold delivered negative return in two positions out of three.

5. Conclusion

From the results we conclude that it is possible to create profitable market neutral positions with gold and silver. The algorithm we proposed in the paper has worked satisfactorily and can be further tested and utilized. We also conclude that correlation test satisfactorily helps in determining security pairs for pairs trading. We also conclude that stochastic method helps in finding entry and exit points for market neutral strategies.

6. Scope for further research

In this research we have only tested gold and silver to study the effectiveness of proposed algorithm. We have also tested the algorithm for stochastic period of 200 days. Further tests can be conducted with other securities and for different period to calculate percentage rank.

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