Assignment 4 - Pairs Trading

Aliaksandr Panko

March 26, 2018

Contents

1 Objectives

1. Study the above for Dow Jones Transportation Average and Dow Jones Industrial Average.

2. Make a note of the technical indicator panels provided – The stochastic and the Moving Average Convergence Divergence (MACD)

3. Using all the technical information available, provide a pairs trading recommendation. Provide concrete reasoning to support your choice. Did the Stochastics and MACD help you in deciding on the direction of pairs trade? If not, which indicator would have been ideal?

4. Write a Python program to download data for Dow Jones Transportation Average and Dow Jones Industrial Average for the last 5 Years

5. Create and calculate any one indicator that would allow you to decide on making a pairs trade between these 2 indices.

6. Based on the historical values of that indicator, calculate and graphically represent the return profile of a pairs trading strategy

2 DJTA & DJIA

The Dow Jones Transportation Average (**DJTA**, also called the **"Dow Jones Transports"**) is a U.S. stock market index from S&P Dow Jones Indices of the transportation sector, and is the most widely recognized gauge of the American transportation sector. It is the oldest stock index still in use, even older than its better-known relative, the Dow Jones Industrial Average (DJIA).

The Dow Jones Industrial Average(DJIA), or simply the **Dow**, is a stock market index that shows how 30 large publicly owned companies based in the United States have traded during a standard trading session in the stock market. The value of the Dow is not a weighted arithmetic mean and does not represent its component companies' market capitalization, but rather the sum of the price of one share of stock for each component company. The sum is corrected by a factor which changes whenever one of the component stocks has a stock split or stock dividend, so as to generate a consistent value for the index. It is the second-oldest U.S. market index after the Dow Jones Transportation Average.

3 MACD & Stochastic

3.1 MACD

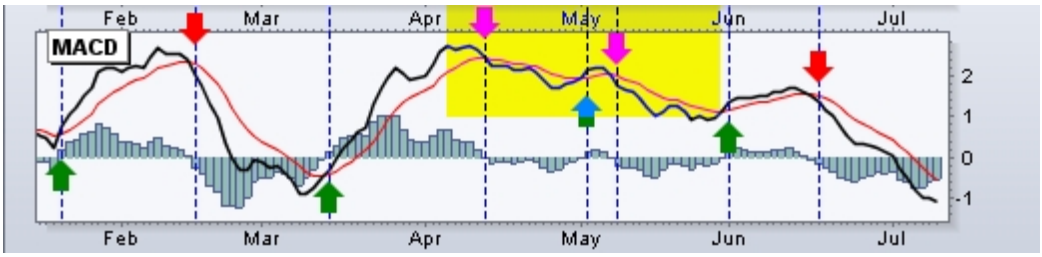
The moving average convergence divergence (MACD) is one of the most wellknown and used indicators in technical analysis.

$$MACD = EMA_{short} - EMA_{long} \tag{1}$$

- The most common moving average values used in the calculation are the **26-day** and **12-day** exponential moving averages. The signal line is commonly created by using a **9-day** exponential moving average of the MACD values. These values can be adjusted to meet the needs of the technician and the security.

- When the MACD is positive, it suggests upward momentum. The opposite holds true when the MACD is negative.
- Signal line crossovers are the most common MACD signals. A bullish crossover occurs when the MACD turns up and crosses above the signal line. A bearish crossover occurs when the MACD turns down and crosses below the signal line.

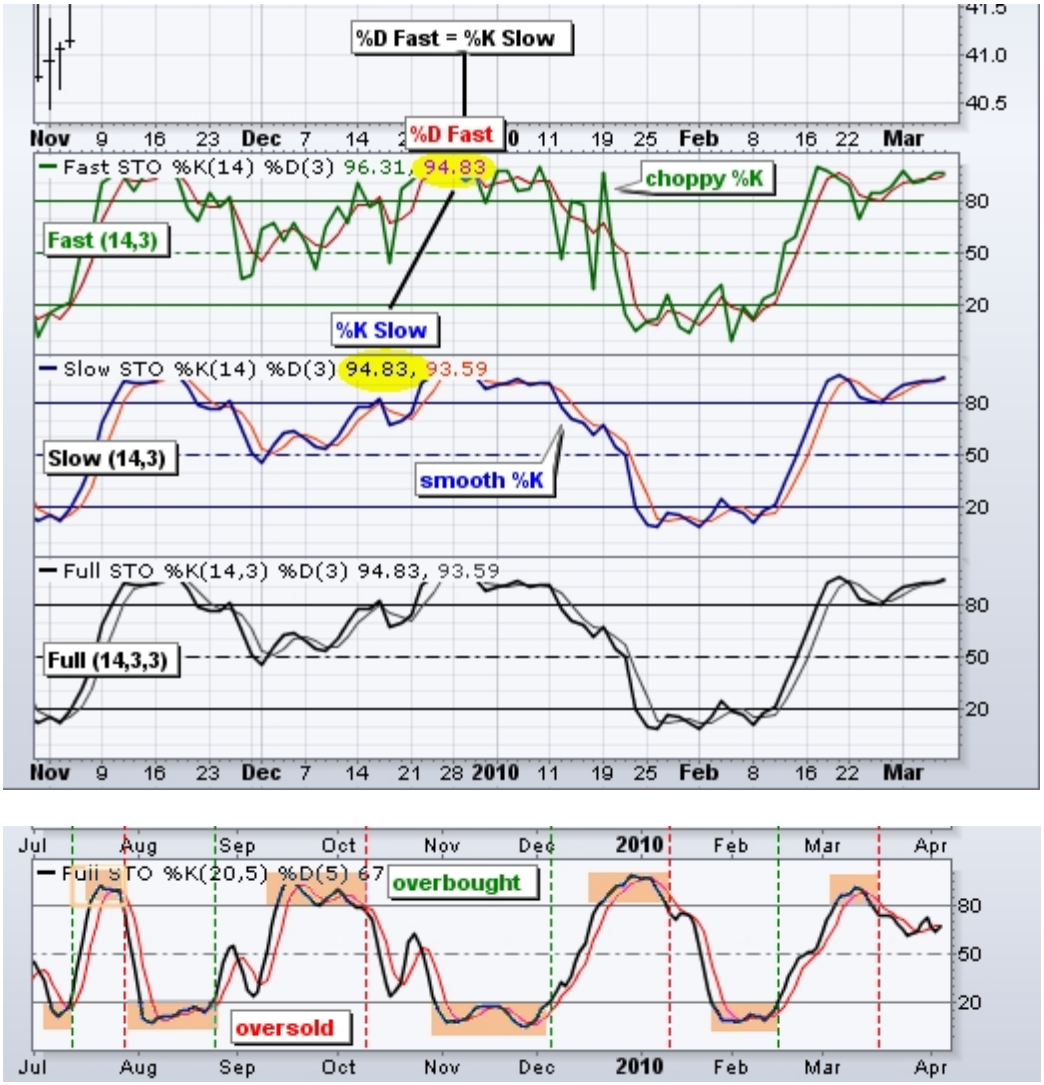
The MACD histogram is plotted on the centerline and represented by bars. Each bar is the difference between the MACD and the signal line or, in most cases, the nine-day exponential moving average.



The detailed overview of the indicator can be found here

3.2 Stochastic

- The idea behind this indicator is that in an uptrend, the price should be closing near the highs of the trading range, signaling upward momentum in the security. In downtrends, the price should be closing near the lows of the trading range, signaling downward momentum.
- The stochastic oscillator is plotted within a range of 0 and 100 and signals overbought conditions above 80 and oversold conditions below 20.
- According to an interview with Lane, the Stochastic Oscillator "doesn't follow price, it doesn't follow volume or anything like that. It follows the speed or the momentum of price. As a rule, the momentum changes direction before price."



3.2.1 Fast, Slow or Full

I found three versions of the Stochastic Oscillator:

1. **Fast Stochastic Oscillator:**

   Fast %K = %K basic calculation

   Fast %D = 3-period SMA of Fast %K

2. **Slow Stochastic Oscillator:**

   Slow %K = Fast %K smoothed with 3-period SMA

   Slow %D = 3-period SMA of Slow %K

3. **Full Stochastic Oscillator:**

   Full %K = Fast %K smoothed with X-period SMA

   Full %D = X-period SMA of Full %K

4 Analysis

Things to notice:

- we are working with a ratio: $\frac{TRAN}{INDU}$
- MACD(12,26,9) (standard one) is used
- Slow STO %K(14), %D(3) is used

4.1 Trading Strategy

Since MACD slower than oscillator but more sensitive, I try the next approach:

1. When stochastic oscillator crosses 80th percentile from above - **SELL TRAN** and **BUY INDU**.
2. When stochastic oscillator crosses 20th percentile from below - **BUY TRAN** and **SELL INDU**.
3. When the MACD turns up and crosses above the signal line - ratio $\frac{TRAN}{INDU}$ goes up $\implies$ **BUY TRAN** and **SELL INDU** if this operation is not already done.
4. When the MACD turns down and crosses below the signal line - ratio $\frac{TRAN}{INDU}$ goes down $\implies$ **SELL TRAN** and **BUY INDU** if this operation is not already done.

4.2 Strategy Backtesting

Let's now apply this strategy to our example:

This strategy allowed us to make more money in first 2 cases and make some money during horizontal trends.

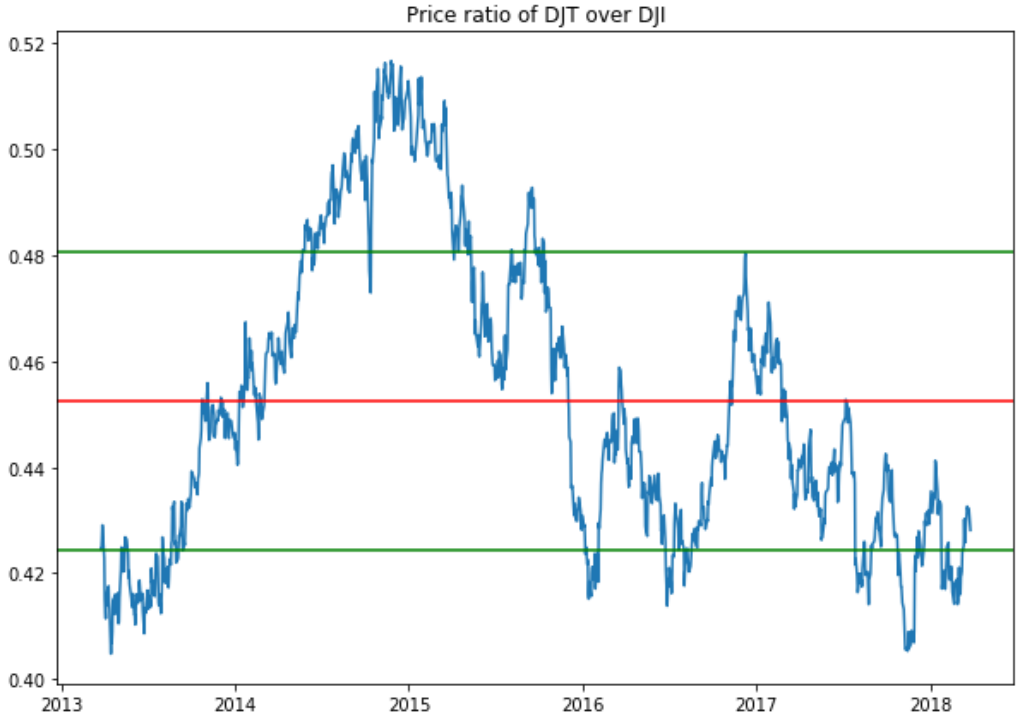
5 Implementation

5.1 Used Strategy

1. Calculate pair ratio
2. Calculate ratio mean value
3. Calculate ratio standard deviation
4. When the ratio crosses support line from below **BUY TRAN** and **SELL INDU**
5. When the ratio crosses resistance line from above SELL TRAN and **BUY INDU**.
6. In the very end close a position anyway

5.2 Strategy results

The results are represented by cumulative returns:



As we can see the strategy gave us result of 35% profit over the whole period. Taking into consideration that the strategy is fairly simple it is rather good result.