TRADING SYSTEMS

The Right Cocktail

Pair Trading With A Twist

Trading stock pairs may be something that you may not think about much. But if market conditions are such that no trading methodology of yours is going to work, it's best to keep your options open. Here, we look at pair trading to find which approach works best for trading them.

Mature markets like US/European stocks and futures exchanges are getting crowded. Globalization, easy access to trading platforms, and low brokerage commissions are attracting thousands of people from all over the world to trade financial markets. Although this increases trading volume and brings more liquidity to the markets, it can cause an exponential noise increase on price charts.

It is not unrealistic to expect that mature markets will be tougher to trade, and that means that traders need to think out of the box to find new ways to trade. Over the years, I have come up with an approach to stock pair trading and market-neutral strategies that I would like to share here.

ABOUT THOSE PAIRS

Pair trading—it's defined as a strategy where you match a long position with a short position in two stocks, indexes, ETFs, or anything else, that are usually in the same sector. This creates a hedge against the sector and overall market the two stocks are a part of.

Trading libraries offer several strategies related to stock pair trading. They have two things in common:

- They require a high level of math skills
- All of them (or most of them) are mean-reverting.

Why the high level of math skills? That's because they deal with statistical arbitrage and statistical tools such as regression or correlation models. Most of them are based on mean reversion because they mostly trade only correlated assets. I wanted to analyze the mean-reversion concept further.

- Will the price ratio of two correlated assets really revert back to the mean all the time?
- Is the correlation between two stocks a stable parameter or will it change depending on the market's condition?

I will try to answer these questions by looking at some common stock pairs. In Figure 1 you see the price ratio between Coca-Cola (KO) and Pepsi (PEP). There's a clear four-year downtrend. The two companies are in the same sector, but trading this pair with mean-reverting logic will most likely not be successful because the pair didn't reverse at all

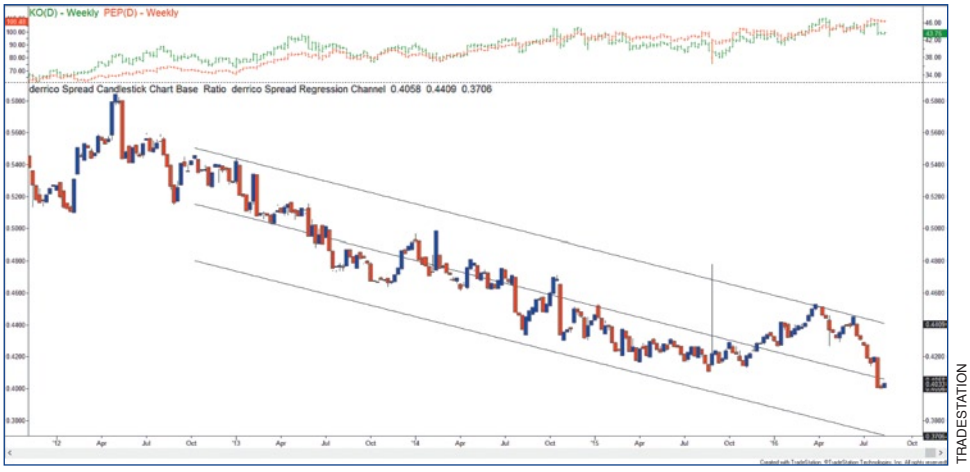


FIGURE 1: TWO STOCKS IN THE SAME SECTOR. You can see there is a clear downtrend here. Trading this pair with mean-reverting logic will most likely not be successful.

by Domenico D'Errico

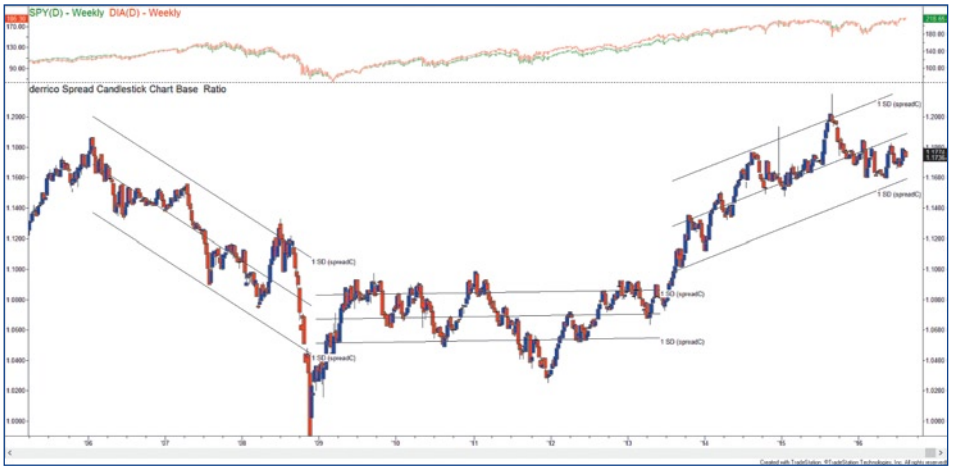


FIGURE 2: AN INDEX PAIR. Although SPY and DIA are supposed to be highly correlated markets, their price ratio moved sideways only in four years out of 10.

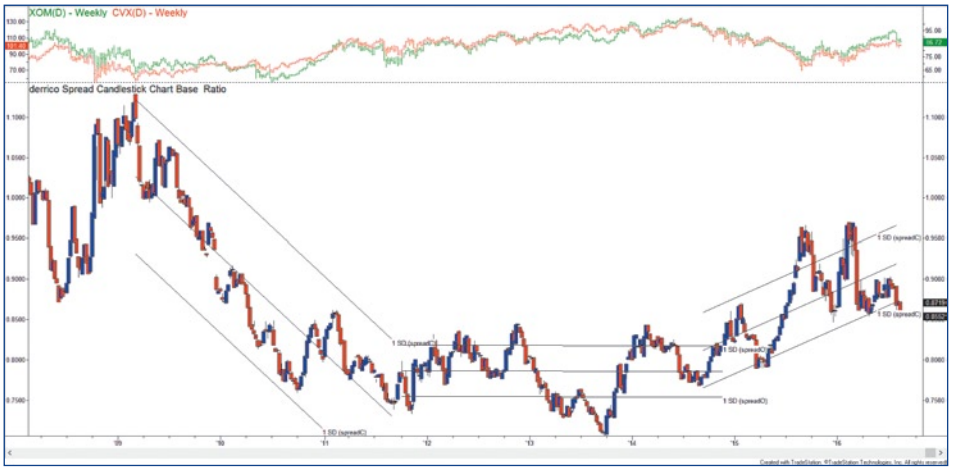


FIGURE 3: AN ENERGY PAIR. The ratio moved in an uptrend, a downtrend, and then sideways like any other financial tool.

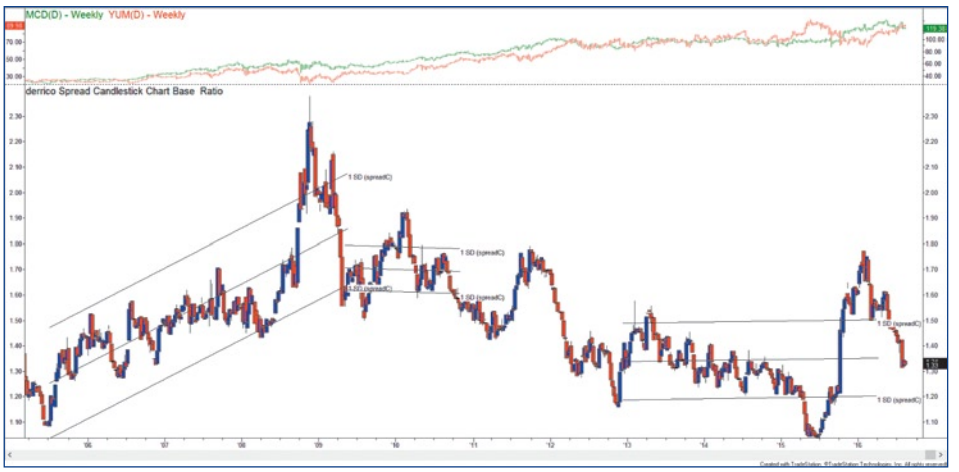


FIGURE 4: MCDONALDS AND YUM BRANDS. After an upward-trending move from 2006 to 2009, this pair traded sideways but with some sharp moves at the end of 2008 and mid-2015.

during this time.

Now if you look at the chart of the SPY and DIA pair in Figure 2 you see three different moves:

- A downtrend from 2006 to 2009
- A sideways move from 2009 to 2013
- An uptrend from 2013 to 2016

Although SPY and DIA are supposed to be highly correlated markets, their price ratio moved sideways only in four years out of 10. Consequently those who traded mean reverting strategies from 2006 to 2009 and from 2013 to 2016 would have lost money.

In Figure 3 you see a pair chart from the energy sector, namely Exxon (XOM) vs. Chevron (CVX). It's the same story as in the previous chart—the ratio moved in an up trend, a down trend, and then sideways like any other financial tool. It doesn't seem to be different than a regular candlestick chart.

In Figure 4 you see a chart of McDonalds (MCD) vs. Yum Brands (YUM) pair. After an upward-trending move from 2006 to 2009, this pair traded sideways but with some sharp moves at the end of 2008 and mid-2015.

In Figure 5 you can see the spread ratio between the September 16 and October 16 crude oil futures contract. We now, finally, have a mean-reverting example. The spread ratio came back to 0.99, so if you traded this pair applying mean-reverting logic, you may have made money.

In these examples, with the exception of the crude oil example, the other stock pairs moved just like any other financial tool: They can trend up, trend down, or move sideways. And that tells me that correlation is perhaps not a stable parameter, because it changes, just like anything else in the market.

BUT ISN'T FOREX A PAIR?

A forex pair or cross is a price ratio between two different currencies. In other words, when you buy EURUSD, you are buying euros and selling US dollars simultaneously. Have you ever thought of trading forex crosses only through mean-reversion strategies? That, my friends, could be suicidal.

I strongly believe that two classical approaches—trend-following and mean-reverting—can work the same for stock pairs

as well as for any other pair, depending on the markets' conditions.

IT COMES DOWN TO USING THE RIGHT TOOLS

I decided to make it simpler, so I got rid of correlation analysis and other interesting but complicated statistical tools and focused just on price-ratio action:

- If two stocks are not correlated, their price ratio will show a trend.
- If two stocks are correlated, their price ratio will be choppy.

But how do you achieve this task? How do you know if the pair is trending or choppy? Technical analysis may be able to help.

Let's have a look at some price-ratio charts with technical indicators applied to them. In Figure 6 you see a sector vs. an index pair: XLE vs. SPY. After about a year of moving sideways (July 2013 to July 2014) as confirmed by flat moving averages, the pair started a downward move that ended in early 2016. During this period, the four-week moving average (green line) was below the 40-week moving average (red line). At the beginning of 2016, the two moving averages converged, and then the price ratio crossed above the faster average, indicating that a reversal was in place. The reversal was confirmed by the linear regression channel and by the moving average crossover in June 2016. The new low made in January 2016 is the current support level. The moving average cross histogram in the subchart shows six different changes in the trend's setup.

In Figure 7 you see an example from the energy sector—Chevron vs. the energy sector ETF (XLE). After a down move from July 2013 to July 2014, the pair made a rally and then showed a distribution pattern. The moving average cross histogram in the subchart shows seven different changes in the trend's setup.

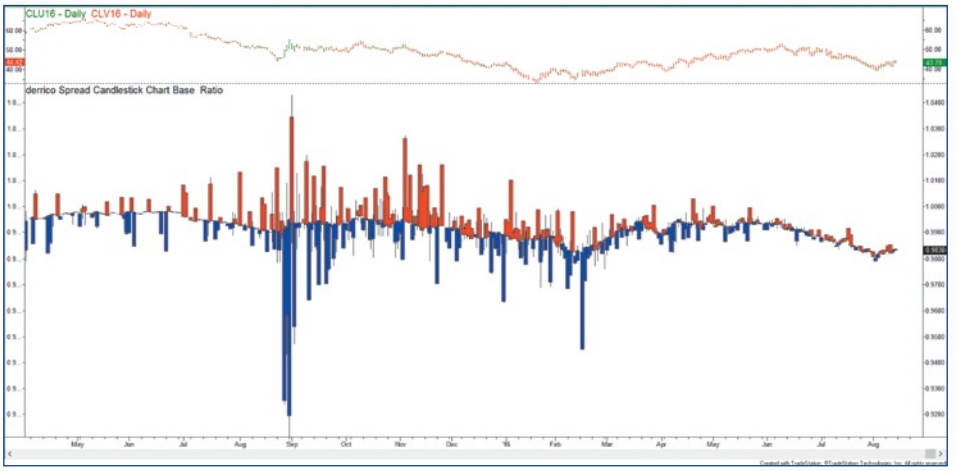


FIGURE 5: FUTURES PAIRS. Here you see the spread ratio between the September 16 and October 16 crude oil futures contract. This pair did mean-revert. Note how the spread ratio came back to 0.99.

FIGURE 6: APPLYING TECHNICAL ANALYSIS TO SECTOR VS. INDEX. Here, moving average crossovers and linear regression channels show if the XLE/SPY pair is moving in a trend or if it's choppy.

FIGURE 7: ENERGY SECTOR. In this example, you see from the chart that there were seven different changes in the trend's setup.

In Figure 8 we move to the technology sector and look at IBM vs. the technology sector ETF (XLK). There's no doubt the pair is trending down. There may be some signs of strength from the moving average crossover in April 2016, which is confirmed by a rising regression channel. The new low made in November 2016 is the current support. The moving aver-

age cross histogram in the subchart is quite stable, showing only four different changes in the trend's setup.

Next, look at the financials in Figure 9, where you see JPM vs. the financial sector ETF (XLF). It seems that the pair has been moving sideways since 2012, offering some potential for mean-reverting strategies. The moving average cross histogram in the subchart shows 14 different changes in the trend's setup, confirming there was no defined direction.

AND THE BACKTESTS SHOW …

To understand whether this approach makes sense, I crunched some numbers and tested the following three different technical approaches on the S&P 500 stock pairs versus the SPY:

a. Trend-following strategy based on two moving averages cross
b. Mean-reverting strategy based on a single moving average
c. Trend & pullback strategy (a combination of A and B).

Settings

Time frame: Weekly
Period: Jan 2002–Aug 2016
Leg2: SPY
Fast moving average length = 4
Slow moving average length = 40
No commissions and slippage included.

Trading rules

- **Trend-following**
  - When the price ratio fast moving average crosses above the slow moving average, you *buy* the stock and *sell short* the SPY
  - When the price ratio fast moving average crosses below the slow moving average, you *close* both stock and SPY positions
- **Mean-reverting**
  - When the price ratio goes below the fast moving average, you *buy* the stock and *sell-short* the SPY
  - When the price ratio goes above the fast moving average, you *close* both stock and SPY positions.
- **Trend & pullback**
  - When the price ratio fast moving average is above the slow moving average and the price ratio goes below the fast moving average, you *buy* the stock and *sell-short* the SPY

FIGURE 8: TRENDS IN TECH PAIRS. It's clear this pair is trending down. The moving average cross histogram in the subchart is quite stable, showing only four different changes in the trend's setup.

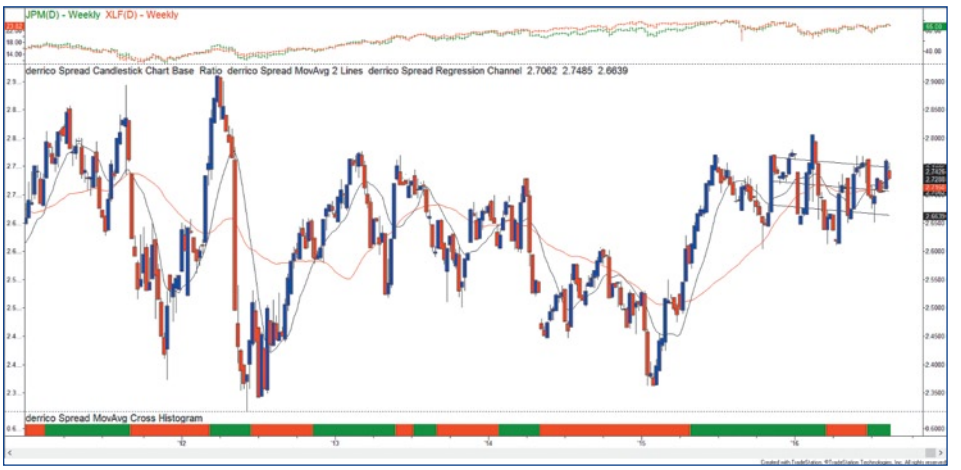
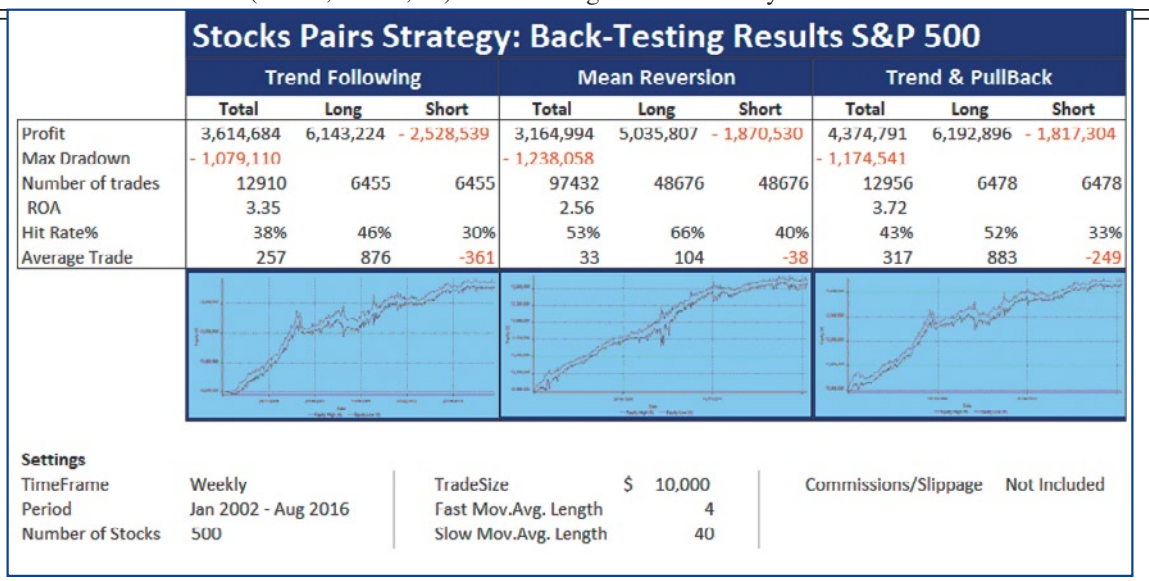


FIGURE 9: NO DEFINED DIRECTION IN FINANCIALS. The pair has been moving sideways since 2012, offering some potential for mean-reverting strategies. The moving average cross histogram in the subchart shows 14 different changes in trend's setup, confirming that there was no defined direction.

FIGURE 10: THE TREND-FOLLOWING STRATEGY AT WORK



Stocks Pairs Strategy: Back-Testing Results S&P 500

	Trend Following			Mean Reversion			Trend & PullBack		
	Total	Long	Short	Total	Long	Short	Total	Long	Short
Profit	3,614,684	6,143,224	- 2,528,539	3,164,994	5,035,807	- 1,870,530	4,374,791	6,192,896	- 1,817,304
Max Dradown	- 1,079,110			- 1,238,058			- 1,174,541		
Number of trades	12910	6455	6455	97432	48676	48676	12956	6478	6478
ROA	3.35			2.56			3.72		
Hit Rate%	38%	46%	30%	53%	66%	40%	43%	52%	33%
Average Trade	257	876	-361	33	104	-38	317	883	-249

FIGURE 11: BACKTESTING RESULTS FOR TREND-FOLLOWING, MEAN-REVERSION, AND TREND & PULLBACK

- When the price ratio fast moving average is below the slow moving average and the price ratio goes above the fast moving average, you *close* both stock and SPY positions.

In Figure 10 you can see a trend-follower entry/exit example on the pair IBM/SPY.

POSITION SIZING DOES MATTER

Managing the number of shares in market-neutral strategies is similar to managing ingredient portions when you prepare cocktails: You may have the right ingredients, but if the portion sizes are incorrect you'll end up with a crappy cocktail.

I am going to use a dollar-neutral approach for my back-tests. I also hedged 100% of the trade value. Let's analyze the backtesting results provided in Figure 11 and Figure 12. The main considerations are:

Managing the number of shares in market-neutral strategies is similar to managing ingredient portions when you prepare cocktails.

- All three strategies show a positive P&L, which is a good start; the trend & pullback approach seem to be the most profitable for long and short trades.
- All three strategies show a negative P&L for the short side, meaning the hedging impact is probably too heavy. It could be reduced by downsizing the short trading sizes a bit.
- In terms of hit rate percentage, the mean-reversion

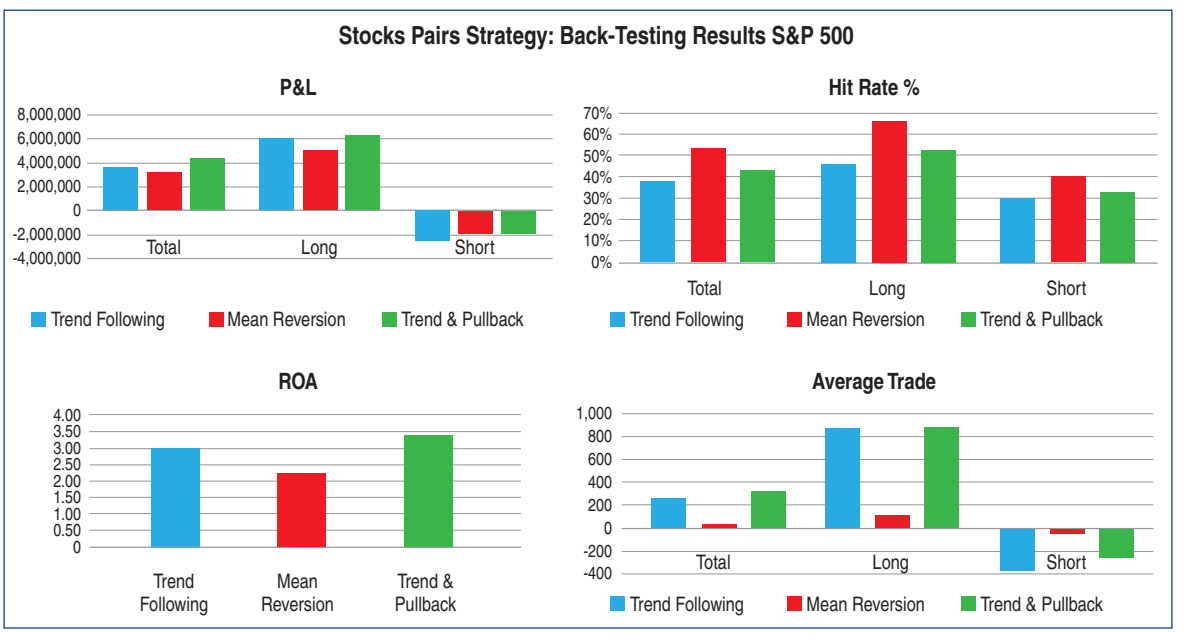


FIGURE 12: BACKTESTING RESULTS BY P&L, HIT RATE %, ROA, AVERAGE TRADE

strategy shows the best results, with 66% profitable trades for long and 40% for short. This is something we can expect for reversal strategies. Hit rate percentage refers to how many trades are profitable out of 100.

- In terms of average trade, for both the long and short side, the trend & pullback strategy with 12,956 trades and an average of $317 (3.17%) is the best, while the mean-reverting results are quite poor due to the large number of trades (97,432).
- It's the same story for return on account (ROA), showing that trend & pullback (ROA 3.72) improves the trend-following approach (ROA 3.35), while the mean-reverting performs worse (ROA 2.56). ROA is a strategy performance measure calculated by dividing the total profit by the maximum strategy drawdown.

TRENDS AND PAIRS

We can draw the following conclusions:

- Stock pairs can be traded with opposite approaches like any other financial tool: you cannot predict if the pair will move in a trend or sideways since it is the market that decides.
- You don't necessarily have to use complicated statistical calculations where classical technical analysis is more than enough.
- Yes, the mean-reversion approach works, but trend-following is better. And when you combine the two, it's even better—you're looking for pullbacks inside the main trend.

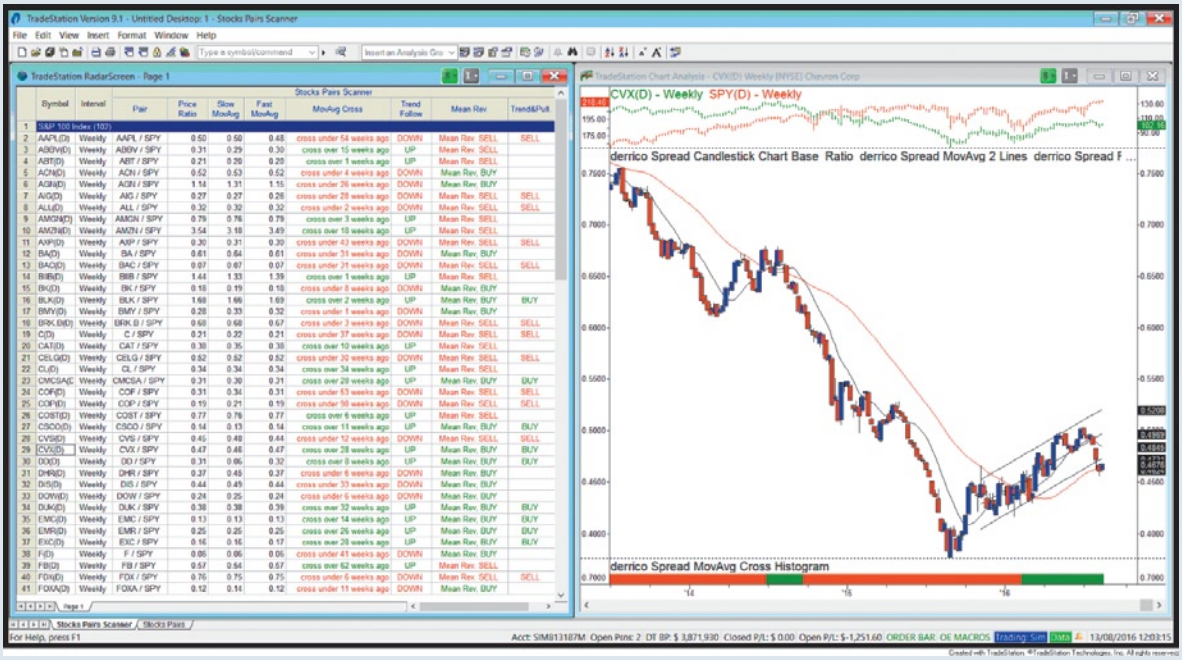
Domenico D'Errico has a statistics background, is an app developer, and works as an advisor for asset managers and professional traders from different countries. He may be reached via his website Trading-Algo.com.

*See our **Traders' Tips** section beginning on page 51 for commentary on implementation of D'Errico's technique in various technical analysis programs. Accompanying program code can be found in the Traders' Tips area at Traders.com.*

STOCK PAIR SCANNERS

The most common trading platforms don't provide technical analysis tools for stock pairs. What you *can* find are some spread-ratio indicators. But this is not enough for us, because we need to clearly visualize price-ratio moves. We need candlesticks, trend indicators, and reversal indicators, all of them applied to price ratios. This is why we redesigned most of the analysis techniques available and created a complete stock pair indicators library.

But how do you scan thousands of different pair combinations in the US stocks/ETF universe? You need to create some type of market scanner that monitors your strategies on thousands of pairs without opening a chart. In sidebar Figure 1 you see an example of a scanner I created.



SIDEBAR FIGURE 1: A PAIR SCANNER FOR STOCKS