

What A Nice Pair

Abbott and Costello. Ruth and Gehrig. Butch Cassidy and the Sundance Kid. Some things are better in combination than they are by themselves. Quite a few stocks fall into this category, which forms the basis for a branch of hedge fund management called matched pair or relative value trading; this strategy in turn is a subset of the broader Market Neutral category defined by Van Hedge Fund Advisors.

The strategy has much to recommend it. Industries tend to evolve toward oligopoly, or a few large sellers, as they mature. The consolidation process is continuous even in well-established and very mature industries: Witness the shrinkage in the number of major oil companies, banks, security dealers, computer manufacturers, railroads, airlines, software firms, and FCMs over your lifetime.

The mechanics of competition pretty much assure us one firm will gain or lose value relative to its nearest rival. Since there is no natural limit to this relative advantage – contemplate the course of a Microsoft / WordPerfect spread from 1986 onwards - an unbounded spread (see “Think Before You Spread,” *Futures*, April 2001) results.

The Opportunity

Single stock futures will facilitate matched pair trading by virtue of their ease in going short a position and their lower margin requirements for those who normally are charged the 50% Regulation T margin. To short a stock under traditional procedure, a trader must locate the stock and then borrow it at broker loan, one of the highest short-term interest rates this side of a credit card. Once all of the stock available for lending is lent, no additional short positions can be emplaced.

Futures do not have this problem: You want to sell? Then sell. Could you imagine trading corn if you first had to locate bushels in an elevator in order to take a short position? Moreover, there is a huge cultural difference between futures traders and equities traders. Futures traders are quite comfortable in going short, and the rules and regulations of the industry treat the long and short parties fairly equally. Short selling in stocks got a bad name in the aftermath of the 1929 crash, and as a result we have had to live with such encumbrances as the uptick rule – you cannot initiate a short position if the stock is going down – ever since.

An important distinction in financial law and economics exists as well. Stocks represent ownership shares in the issuing corporation, while all futures contracts represent a financial claim on those shares. This disconnection of the financial claim from the underlying asset opens up a world of trading strategies and has made possible the massive social benefits that have accrued from derivatives trading, such as the continued availability of mortgage credit whenever the Federal Reserve raises short-term interest rates.

Risk Reduction

As a bonus, the underlying economics of the pair trade often produces a spread with persistent trends; as one firm gains advantage due to some technological or marketing innovation, its gains often turn into its competitors' direct or opportunity losses. After all, every bottle of Coca-Cola sold is a bottle of Pepsi Cola remaining on the shelf.

However, as we shall see below, not all pairs involve such a zero-sum tradeoff. Firms who sell unrelated products and services to the same industry see their fortunes rise and fall not as a function of their relative advantage to one another, but rather as a function of the customer industry's health. The nature of the spreads within this category can be divided further into those with a direct and undiversified reliance on a common customer base and those whose customer bases, in Venn diagram terms, overlap but do not intersect completely.

In either case, the spread comes with a built-in reduction in trade volatility. If we buy stock A and sell stock B in equal quantities, the resulting variance of the spread is:

$$\sigma^2_{A-B} = \sigma^2_A + \sigma^2_B - 2 * Cov_{A,B}$$

The more positive the covariance, defined below, of A and B is, the greater the overall risk reduction. At the extreme, say buying the cheapest-to-deliver bond and selling the bond future and converting the pair into a repo rate, this is obvious.

$$Cov_{A,B} = \frac{1}{N} \sum_{i=1}^N (A_i - \mu_A)(B_i - \mu_B)$$

Since covariance takes on non-intuitive values, it is commonly converted into correlation by normalizing to the standard deviations of both products, as seen below. Correlation, designated as ρ , ranges from -1.00 for a perfectly negative relationship to 1.00 for a perfectly positive relationship.

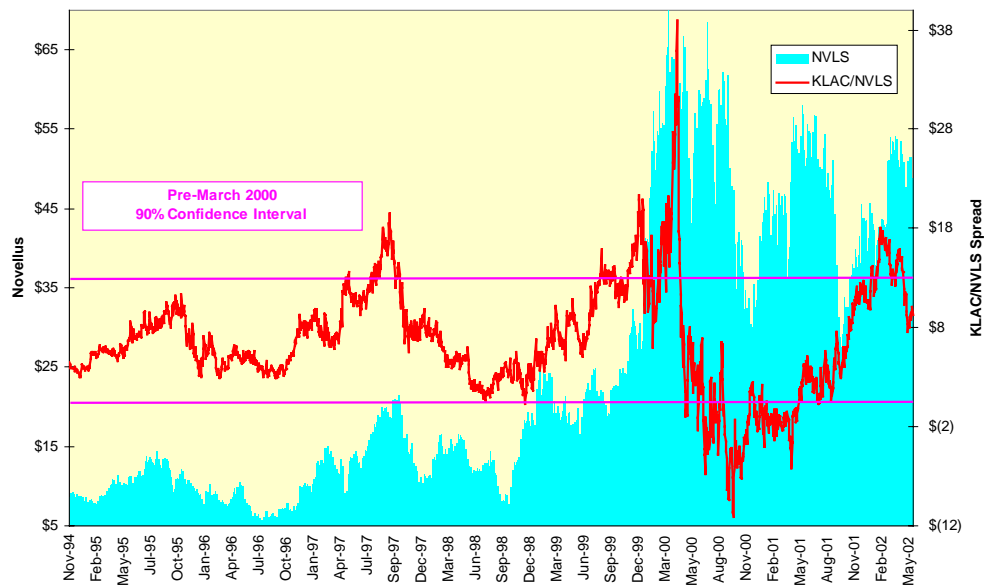
$$\rho_{A,B} = \frac{Cov_{A,B}}{\sigma_A * \sigma_B}$$

Variance and covariance are at the heart of portfolio theory and modern risk modeling. A variance-covariance matrix is at the heart of quadratic programming and all value at risk (VAR) methodologies. But, just as an armor assault without support from artillery and tactical aircraft will produce a nice junk heap on the battlefield, unthinking reliance on these methods alone will produce a similar junk heap in the trading room. The implosions of highly quantitative trading firms such as Enron and Long Term Capital Management stand as testimony to just how effective these methods are when relied upon mechanically.

Let's take a list of forty stocks, all grouped together in pairs with the exception of four pharmaceutical companies. The matrix below is the correlation matrix of daily returns on these stocks from the March 2000 peak of the bull market until mid-May 2002. The rows are labeled with the stocks' names; the columns are labeled with the stocks' tickers. As is the custom given the symmetry of the matrix along its diagonal, only one triangle is shown.

The matrix is color-coded to highlight some key relationships. The correlation for the pair's returns is in a bright yellow background with red lettering; the correlation between American International Group and Cigna, both insurers, is 0.42. If, however, another stock's returns in the column are more correlated, the cell is highlighted with a violet background. For example, Bank of American and Wells Fargo, both banks, have a greater correlation of returns, 0.45 and 0.49, respectively, to AIG than does fellow insurer Cigna.

Good Buy, Mr. Chips



This spread, therefore, is an example of a non-zero sum relationship within a given industry. We should expect their spread to glide along with the highly volatile SOX and then occasionally be rocked by a single company event. The spread's volatility jumped as the Nasdaq bubble burst in the spring of 2000; first KLAC outperformed briefly, and then NVLS withstood the selling onslaught better. Once the initial shock dissipated, the spread's range and volatility moved back into the range prevailing prior to March 2000.

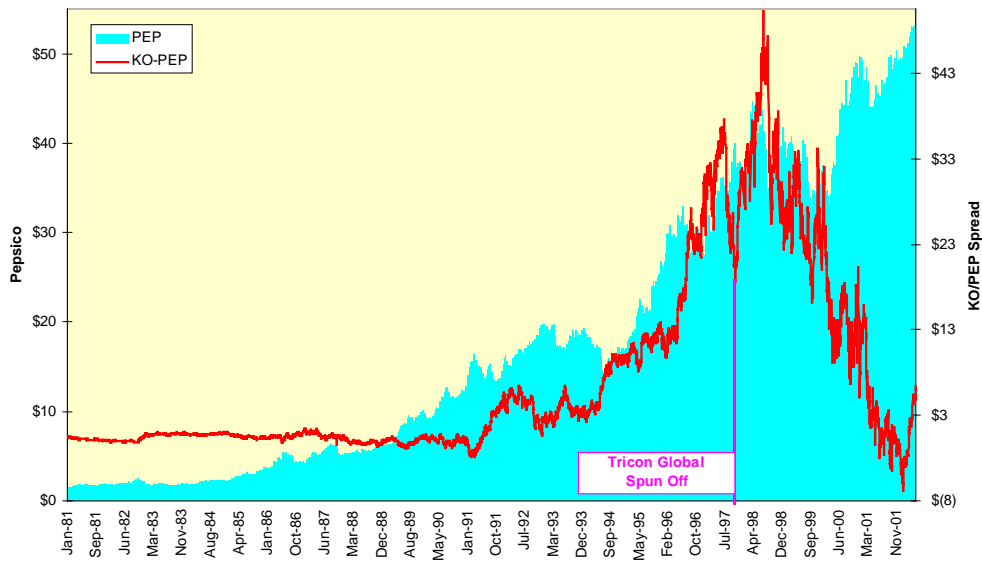
What sort of trading strategy is suggested for spreads of this class? Like any process with an apparent reversion to the mean interrupted by a shock, a process also known as a jump-diffusion, the temptation is to sell option premium when the underlying asset moves out of its normal range. However, this temptation should be resisted at all costs for two reasons. First, unlike commodities, stocks reflect a continuously changing underlying entity whose value relative to another firm can change permanently and drastically (see "Two Sides of Different Coins," *Futures*, May 2002). Taking a countertrend trade against such a move in hopes of a regression to a more normal value could be fatal. Trading the individual legs of a spread is a good idea only for mean-reverting processes with a single embedded option, such as the crude oil crack spread (see "No Margin For Error," *Futures*, February 1999).

The second reason is you would need to trade an option on the spread itself, and not on one of the underlying legs. It is quite easy to see how the KLAC/NVLS spread jumped higher quickly even as NVLS increased rapidly in price during the spring of 2000; the implication, of course, is KLAC rose even faster during those heady days. A buy KLAC / sell KLAC call option combination held against a short NVLS position would have been a losing position as the prices of both stocks rose. Ideally, you would be able to trade an option on the spread itself as the underlying asset, but spread options have their own peculiar characteristics involving both assets' volatilities and the presumption of stable correlation between the two legs (see "Not All It's Cracked Up To Be," *Futures*, July 2000). Moreover, the acceptance rate of exchange-traded spread options has been minimal to-date, and the transaction costs for over-the-counter spread options is high.

Things Go Better With Spreads

We can return now to the more familiar zero-sum spread, exemplified here by Coca-Cola and Pepsico. For the first ten years of Roberto Goizueta's chairmanship, 1981-1991, the two firms' stocks moved in tandem adjusted for splits. Then Coca-Cola began a period of outperformance from 1991 through 1998, a trend that continued even as Pepsico spun off its stagnant Tricon Global restaurant (KFC, Pizza Hut, Taco Bell) group in September 1997 and Goizueta died in October of that year.

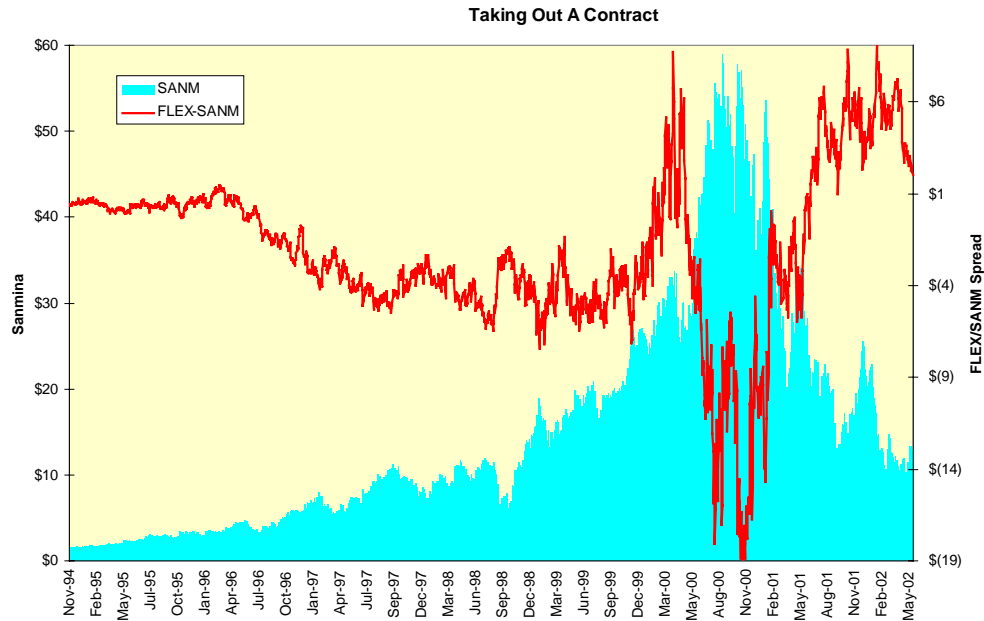
Reversal Of Fortunes



But the change of leadership and Pepsico's renewed focus on its core business changed the spread's trend and powered a massive reversal of the long-term trend. The trend itself has no definite bound on either side, nor do we see any embedded option. This type of matched pair spread exhibits the trend persistence normally seen only in currency trades, and for good reason: All currency trades are really just a matched pair between two short-term interest rates.

Trending Spreads For The Impatient

One of the most difficult things for most traders to do is nothing, and the long-term trend seen in the KO/PEP spread requires the patience of Job to do well. Let's take a look at a matched pair that is similarly unbounded and based on substitution, this time services instead of goods, that between electronics contract manufacturers Flextronics and Sanmina.



This is a matched pair trade that lies somewhere in between what we have seen in KLAC/NVLS and KO/PEP. The health and earnings prospects of both firms depend on the total demand for electronics manufacturing services, and they compete with each other in overlapping markets. But their competition is not zero-sum as the total market can expand and contract and one firm can gain a niche advantage without necessarily taking business away from the other. In addition, the business of both firms is less specialized and dependent on the health of a single industry than we saw in the KLAC/NVLS case.

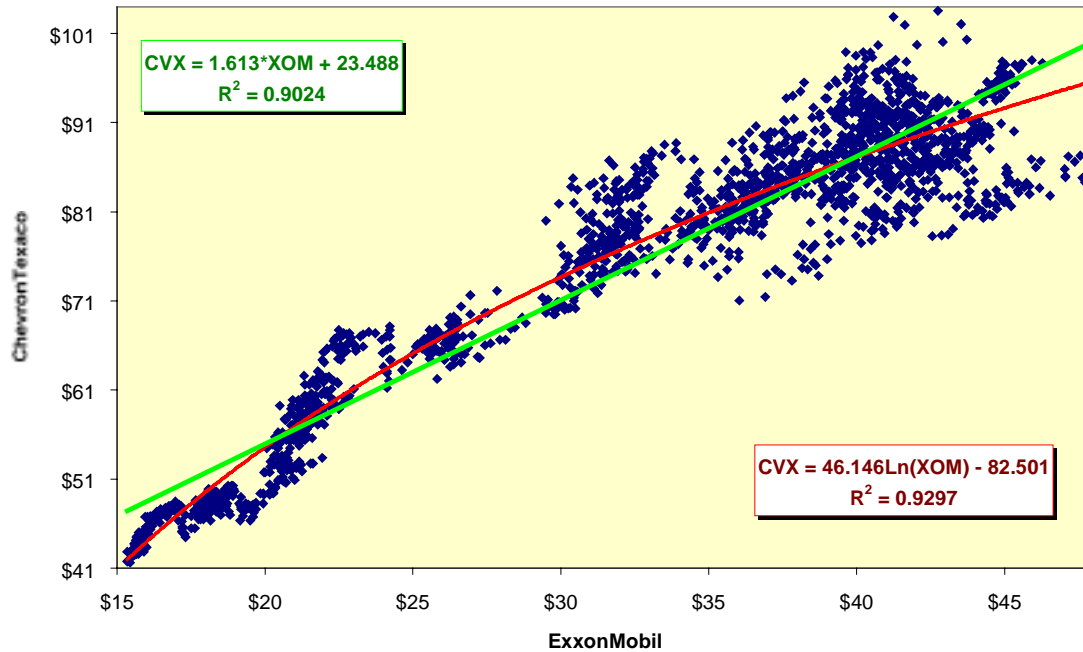
The spread between the two has been largely a function of the SANM price over the past eight years, but clearly other outcomes could have been possible. This suggests that a trading strategy for matched pairs involving closely related but indirect competitors should derive from separate trading decisions for each of the legs and not on a decision for the underlying spread itself.

So, why complicate matters by trading the spread? In the case of cash stocks with their cumbersome shorting procedure, you would not do so. In the case of single stock futures, the answer is risk reduction: The variance of the spread is less than 15% of Flextronics' variance and less than 11% of Sanmina's variance.

Size Matters

In all cases of matched pair trading, the proper dollar-to-dollar position sizes should be used to ensure equivalence of risk. This is easier said than done. Not even the most intuitive matched pair trades will hand you a simple, stable hedge ratio derived from a linear regression, as we can see in the relationship between ExxonMobil and ChevronTexaco since November 1994 (pre-merger price histories are reconstructed by Bloomberg Financial).

Linear Is A State Of Mind



A linear relationship, highlighted in green, would tell us to trade 160 shares of CVX against 100 shares of XOM. Such ratios are familiar to commercial hedgers in commodities. But, a log-linear fit, highlighted in red, describes the data far better. With this model a trader would need to adjust the quantity of CVX traded as a function of the logarithm of the XOM price. These non-linear hedge ratios are familiar to all bond market traders (see "The Fate Of The Late, Great Eight," *Futures*, October 1999). In either case, the variance of the residuals, the difference between the observed data and the trend line, expands as a function of XOM price. The phenomenon, known as heteroscedasticity, lowers the reliability of any derived matched pair trade.

The Next Step

No matter how useful an understanding of pairs methodology is, it will always be a specialty strategy in comparison to the much larger and more general practice of active fund managers trying to add value by managing the alpha, or expected incremental return, of individual stocks in relation to a benchmark index such as the Nasdaq Composite or Wilshire 5000. Conceptually, any stock purchase is a spread against the base case of simply accepting this index' return. Where single stock futures will add value is in the opposite trade, selling a stock against the index. This is where we will turn our attention next.