Stock Arbitrage: 3 Strategies
Little Rock - Fayetteville
October 22, 2015
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Arbitrage

- Arbitrage is taking advantage of a price distortion in two related stocks, ETFs, or futures markets. When you are both long and short two stocks, it’s called “pairs trading.”
- You can find candidates by observing the charts, and knowing that there is a fundamental similarity. It can be banking stocks, technology, or non-ferrous metals.
- It tries to capture profits by entering a trade when prices have moved apart and exiting when they move back together.
- It is also called “stat-arb” because it is mathematical (statistical) arbitrage. It is also “Relative Value Arbitrage” because there are no absolute price levels at which we trade, only relative differences.
- Typically, arbitrage doesn’t care about the trend of prices.
3 Variations

- We’ll look at 3 different techniques to profit from these “anomalies” in price:
  - The standard deviation
  - The Stress indicator
  - A long-only with an index hedge

- The good news is that this arbitrage is very forgiving. You can use a number of different methods successfully. You can be late to enter or late to exit and still have good profits.
Pairs candidates in the U.S. – they should not be a perfect fit
Correlations are remarkably similar, mostly between 0.30 and 0.60 – not too tight, not too loose

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Qualifying the candidates

• The “best” way is cointegration
  o Calculate the linear regression of each stock
  o Find the residuals (the variation around the regression line)
  o Test that the residuals cancel each other out over time
  o This can be a tricky calculation which we’ll leave to the quants
  o (See Carol Alexander, Market Models, and Ernest Chan, Algorithmic Trading)

• Correlation also works
  o Correlations that are not too low (about 0.25) or too high (0.80)
  o It’s good if they vary a lot around an average of 0.50.

• Or you can just look at a chart
  o You can tell by looking at a chart if the two stocks are related
  o Two stocks in the same industrial group, they are not necessarily candidates, but two stocks in different groups may be good.
A typical example – PFE and NVS correlation 0.44
Method 1: Trading rules using the standard deviation

- Find the ratio of PFE to NVS
- Find the 20-day average of the ratio
- Sell above the upper band = 20-day moving average of ratio + 0.7*yesterday’s standard deviation.
- Buy below the lower band = 20-day moving average of ratio – 0.7*yesterday’s standard deviation
- Exit at the average
Results of basic standard deviation signals (investment of $1000 \times 2$ for the pair, but only $1000$ for long-only)
Sizing the positions

• The Simple Way
  o Allocate the same investment size to each stock
  o Divide the investment size by the closing price
  o It’s not perfect, but it is a way of using “volatility parity”

• Volatility Parity (a must for futures)
  o Calculate the 20-day average true range (ATR) of each stock
  o Divide and equal investment by the dollar value of the ATR
  o Equalize the position sizes so that the total invested is 2 x investment of one stock

• Given all the uncertainties, simple is best
Removing high volatility

• High volatility, especially extreme volatility, produces very high risk because the two stocks can become disengaged (in addition to making bigger moves).

• We can filtering these trades using the annualized volatility of the returns,
  o Annualized vol = \text{stdev}(20\text{-days of daily returns}) \times \sqrt{252}

• Generally, volatility over 40% to 50% should be skipped.

• This will reduce both risk and returns, but it will reduce risk more.
Volatility was over 100% in 2001 and 2008, with large differences
Profit/Loss with vol filter (2 Hong Kong banks)
Trading during high risk does not have a good payout. If you reject high volatility, another pair can produce profits.
Method 2: The Stress Indicator

- Calculate the 8-day stochastic of PFE
- Calculate the 8-day stochastic of NVS
- Let $X = \text{PFE stochastic} - \text{NVS stochastic}$
- The Stress Indicator is the stochastic of $X$

We calculate the stochastic indicator

$$S_{today} = \frac{\text{Close}_{today} - \text{low}_{n\text{-day}}}{\text{high}_{n\text{-day}} - \text{low}_{n\text{-day}}}$$

This is the relative position of today’s closing price within the high-low range of the past $n$ days.

- The short calculation period gives more signals but smaller unit profits.
8-Day stochastics and the difference
Differences converted to Stress Indicator. Normalizing makes it easier to create rules: Sell in red zone, buy in green zone, exit midway.
Results of PFE-NVS using Stress

[Graph showing Total PL PFE-NVS from 1/8/2001 to 1/8/2015]
Methods 1 and 2: Pros and cons

• Positives
  o Both give the relative highs and lows
  o Stress provides uniform buy/sell levels
  o Stress gives more trading signals

• Negatives
  o Stress does not understand volatility
  o Selling short may be a problem
    • Using the Index for the short sales reduces profits further
  o Per share profits tend to be small
Method 3: Exploiting the upside bias

• We find that the long leg performs better for both stock vs index or stock vs stock

• We can’t capture much of the downward stock trends because they are normally faster moves lasting a shorter time

• But we still need protection if there is a major decline, such as 2000 or 2008
Method 3: Hedging the risk

- In the U.S. there is a strong upwards bias in the market, due to the way the government taxes investments and the way the Fed manages the economy.

- If we use the arbitrage signals but only take the long positions we can increase the per share returns from 3¢ to 30¢.

- We can manage the risk by hedging the total risk exposure when the broad index turns down. We want the index to be positively correlated to the stock that will be hedged.

- We will use a moving average to decide when to hedge using the index, although using multiple periods are better (30-60-120).

- We only hedge 50% of the risk.
Typical results of separating long and short legs – a better pattern and larger returns/share

Taking only the long legs for AMZN-WMT, ignore the shorts

Taking only the short legs for AMZN-WMT, ignore the longs
Sample returns for long-only stock leg with SPY hedge
Sample returns for NVS with an SPY hedge (the hedge only helps during major bear markets)
More about the hedge

• The hedge usually loses money, but it is needed for the extreme cases, such as 2008

• We don’t know the right time period for the hedge, so we use 30, 60, and 120 day moving averages, equally weighted.

• With 3 trends, we hedge 1/6 on each downturn, intending to only protect 50% of the risk. So a potential loss of 40% in 2008 would be a real loss of 20%.

• We hope that the hedge loses money so that we profit on the long position in the stock.
More risk protection

• If we had been long Enron in a rising market when it collapsed, we would have no protection.

• We set a stop-loss at 15% below our entry point for the stock.

• There are very few cases where the stop is hit, and a 15% loss in a portfolio of 10 pairs is only a 1.5% loss in the portfolio. Given the infrequent occurrence, that’s a manageable loss for me.
A Word About Creating A Portfolio

• We don’t have enough money to trade all the pairs.

• We don’t have enough trading signals to keep a large portfolio filled.

• We need to select a smaller set of trades to keep the portfolio filled most of the time.

• We do that by using both long-term and short-term performance criteria, sorting the best, then picking the top stocks. We switch trades as they move in and out of the top tier.

• Performance is the single best criterion for future success. The more criteria you use, the worse the results.
Questions or Comments?

For more detail on trading techniques, refer to

Trading Systems and Methods, Fifth Edition
(John Wiley & Sons), by Perry J Kaufman

Look for the release of

A Guide To Creating A Successful Algorithmic Trading Strategy
(John Wiley & Sons, December 2015)

We would be happy to hear from you and answer any questions

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