

MERGER ARBITRAGE

Confidential Research Memo

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Primer on Merger Arbitrage

- A *merger arbitrage opportunity* is one in which a probable event occurring in the future, i.e. the consummation of the merger, renders the pricing of the shares of two companies on par with each other while they currently trade disparately.
- A *riskless* arbitrage would exist if the merger is certain to be completed, since the pricing disparity can be locked in now and unwound later for a profit.
- However, the disparity exists now precisely because the merger is not certain to be completed. Thus the “arbitrage” is a “risky” one (and hence its namesake “risk arbitrage”).
- The disparity is proportional to the probability that the merger fails to consummate.
- If *all* shares in *all* merger situations were priced correctly, then profits from disparities in pending mergers that are eventually completed should balance losses from those in mergers that are eventually busted.
- However, this statistical balance does not occur in practice. A significantly positive expected post-announcement return is found for the target company’s shares and a negative to zero expected post-announcement return is found for the acquiring company’s shares.

Primer on Merger Arbitrage

- Various economic theories have been proposed to explain the “abnormally” high returns to the target company’s shares and the “abnormally” low returns to the acquiring company’s shares.
- There may be synergy in the acquisition which increases the combined value of target and acquirer (“synergy theory”).
- New information may be generated during the merger process which causes an upward reassessment of the value of the target (“information theory”). Thus even if the merger fails, the target is still perceived to be desirable and accrues a higher return.
- There may be wealth transfer from bidders to the target caused by both a vain high price and exaggerated confidence on the bidders’ part as to prospects after the merger (“hubris theory”).
- Shareholders of the target company may demand a higher return to offset taxes to be paid if the merger consideration is made in cash or a mixture containing cash (“taxation theory”).

Primer on Merger Arbitrage

- Consider the following example:

Company A announces its intention to buy company B by exchanging two of its shares for every share of company B's.

Suppose A's shares traded at \$50 and B's shares trade at \$75 before the announcement.

Immediately after the announcement, A's shares trade down to \$45 and B's shares rise to \$87.

- If the merger is consummated, then two shares of A is worth the same as one share of B. In fact since the shares of A and B are fungible upon consummation, one can buy one share of B for \$87 now and lock in a sale price of \$90 by shorting two shares of A. These shares are held until the resolution of the merger when the B share is exchanged for two A shares to cover the short position in A shares. This will produce a gain of \$3.
- If the merger fails, then it is likely that A shares will trade back at around \$50 and B shares at around \$75. The loss in this case would be \$15.
- The probability p of a successful merger implied by the post-announcement market for A and B shares is given by: $p*3 - (1 - p)*15 = 0$. Thus p is 0.83 if arbitrage profits are statistically zero.
- Arbitrage profits are not statistically zero in practice because the market is pricing in a much lower probability of merger success than that experienced in reality.

Types of Merger and Takeover Deals

- The following are basic types of merger or takeover deals :

<i>Type</i>	<i>Description</i>	<i>Trading Strategy</i>
Cash bid	The merger consideration is entirely in cash expressed as a fixed price to be paid for the target company's shares.	Buy shares of target. Buy call on target and/or sell put on target. Split-strike conversion on target (long at-the-money put, long stock, short out-of-the-money call).
Stock bid (fixed ratio)	A fixed number of shares, m , of the acquirer is to be exchanged for one share of the target. In some cases, m is known only after a <i>pricing period</i> for the acquirer shares.	Buy 1 target share for every m acquirer shares shorted. Various option combinations in the 1: m ratio, e.g. long 1 target call, long m acquirer puts, etc.
Stock bid (collar)	Variation of the fixed ratio stock bid in which the risk of a decline in acquirer share price is reduced by applying an option collar to the price. In effect, the acquirer is offering stock to the target shareholders plus writing a put on the stock in return for receiving a call on the stock. The target shareholders then receive acquirer shares in such way that a lower acquirer share price is offset by a larger number of shares while a higher price is capped, which effectively places lower and upper bounds on the merger consideration.	Buy 1 target share and delta-hedge it with a number of acquirer shares equal to the delta of the collar (long stock, long put and short call combination).
Mixed bid or bid with a stub	Mixed bids are bids involving part cash and part stock. Bids with a stub may additionally involve other financial instruments such as bonds or options.	The bid is analyzed into its components. Each target share is then appropriately hedged with the delta of the equivalent option strategy for each component.

Real-Life Examples of Merger Arbitrage Positions

- Example of cash bid:

Pfizer (PFE) to buy Esperion Therapeutics (ESPR) for \$35 per share in cash. Deal announced during the weekend before Monday Dec 22, 2003.

ESPR opened on Dec 22 at 34.74 and closed at 34.53. ESPR's closing price on Dec 21 was 22.70.

PFE opened on Dec 22 at 34.05 and closed at 34.69. PFE's closing price on Dec 21 was 34.27.

- Trading strategy: Buy ESPR on the close on Dec 22, 2003.
- P/L analysis:

Potential profit	\$0.47 per share
Potential loss (assuming ESPR returns to pre-announcement price)	-\$11.83 per share
Return on arbitrage position	$0.47/34.53 = 1.4\%$ if successful $-11.83/34.53 = -34\%$ if unsuccessful
Probability of merger success assuming no arbitrage	0.96

Real-Life Examples of Merger Arbitrage Positions

- Example of fixed ratio stock bid:

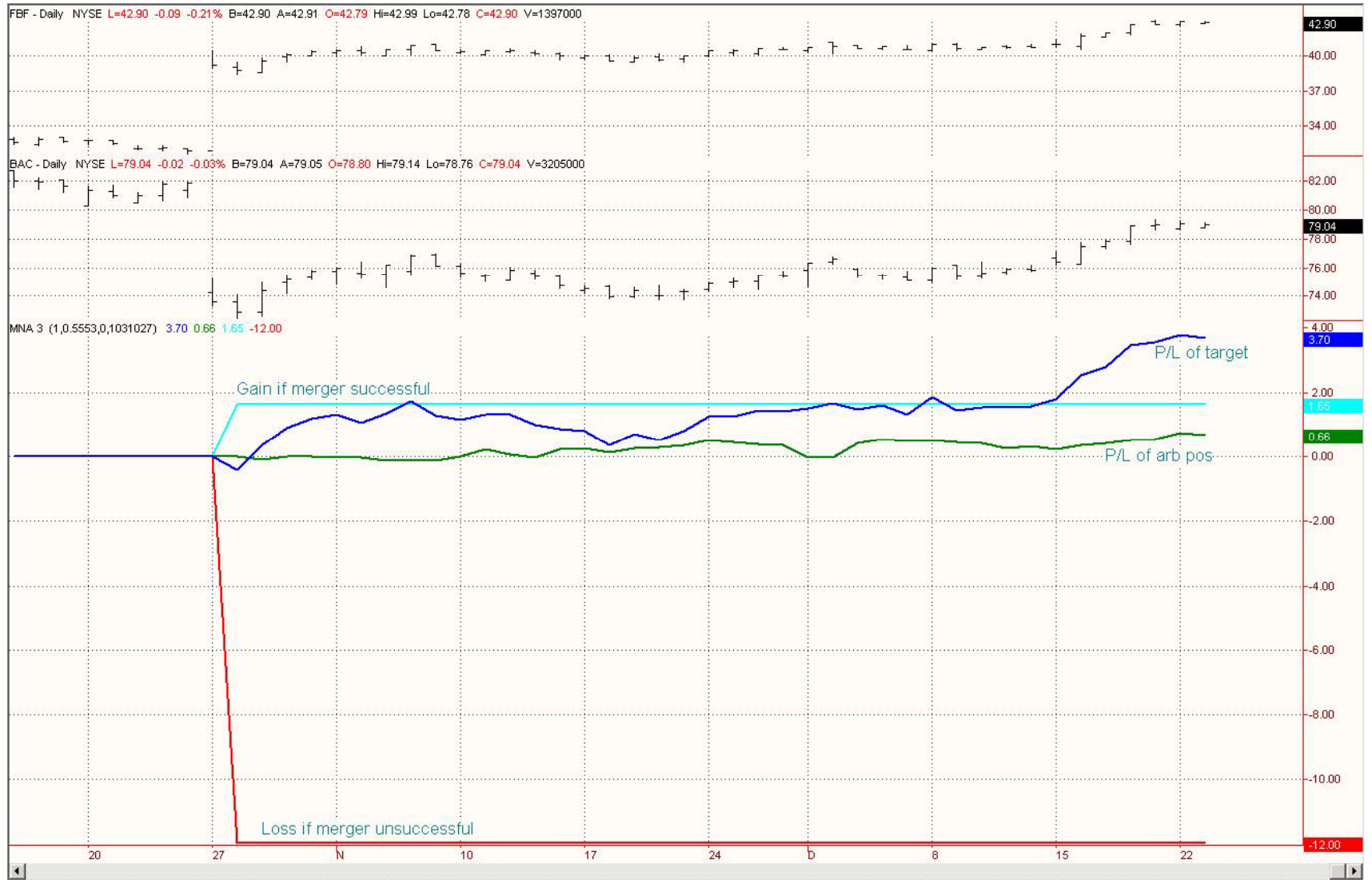
Bank of America (BAC) to buy FleetBoston Financial (FBF) by exchanging 0.5553 BAC shares for each FBF share. Deal announced before market open on Oct 27, 2003.

- Trading strategy: Buy 1 FBF share and short 0.5553 BAC shares at the close of Oct 27.
- P/L analysis: the time evolution of the P/L of the position is shown on the next page.

Potential profit	\$1.65 per share
Potential loss (assuming BAC and FBF return to pre-announcement prices)	-\$12 per share
Return on arbitrage position	4% if successful -30% if unsuccessful
Probability of merger success assuming no arbitrage	0.88

Real-Life Examples of Merger Arbitrage Positions

- Time evolution of the BAC-FBF merger arbitrage position:



Real-Life Examples of Merger Arbitrage Positions

- Example of mixed cash and stock bid:

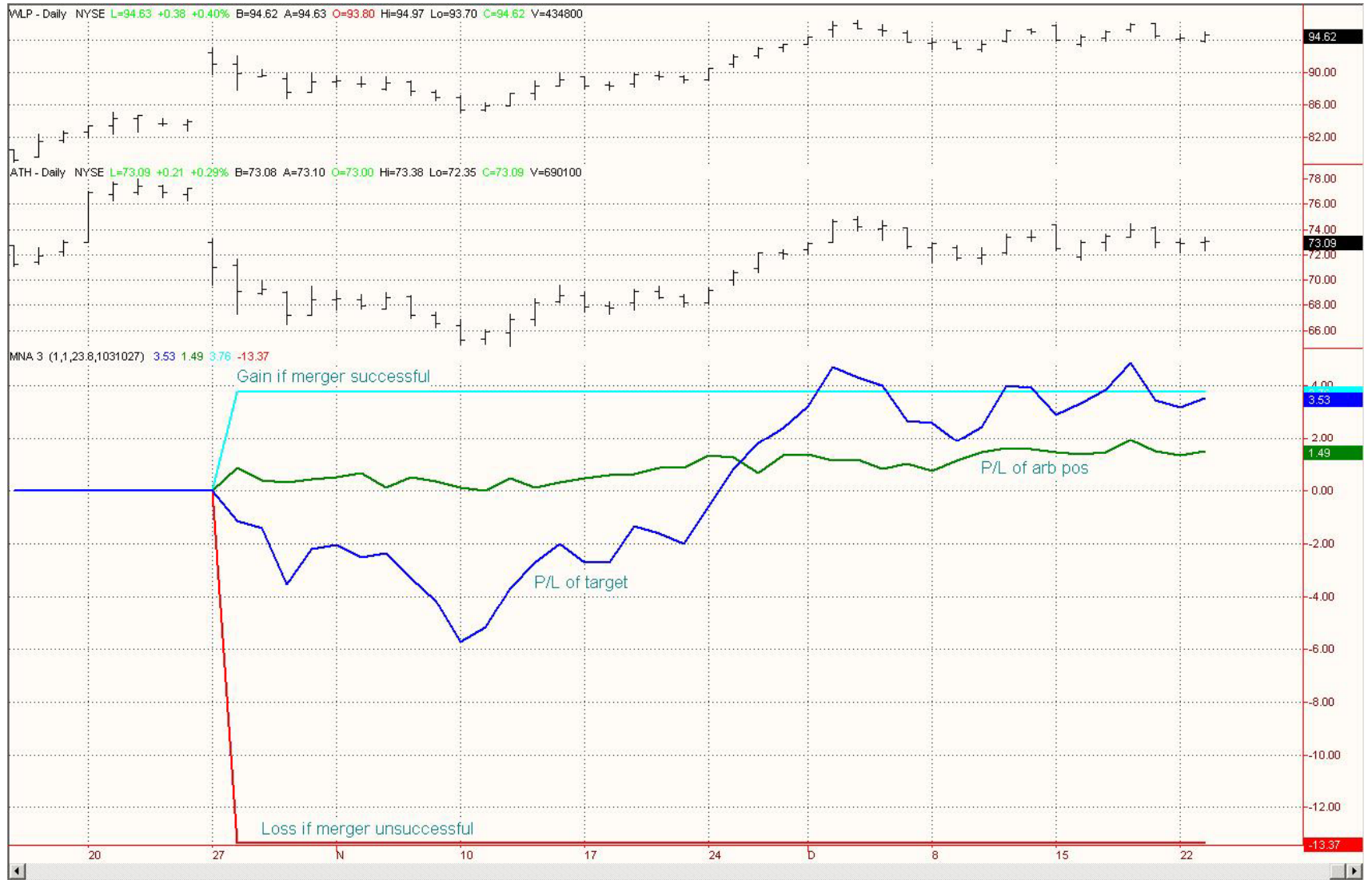
Anthem (ATH) to acquire WellPoint Health Networks (WLP) for \$23.80 per share in cash plus 1 ATH share for each WLP share. Deal announced before market open on Oct 27, 2003.

- Trading strategy: Buy 1 WLP share and short 1 ATH share at close of Oct 27.
- P/L analysis:

Potential profit	\$3.76 per share
Potential loss (assuming ATH and WLP return to pre-announcement prices)	-\$13.37 per share
Return on arbitrage position	4.6% if successful -16.5% if unsuccessful
Probability of merger success assuming no arbitrage	0.78

Real-Life Examples of Merger Arbitrage Positions

- Time evolution of the WLP-ATH merger arbitrage position:



Real-Life Examples of Merger Arbitrage Positions

- Example of mixed cash and stock bid with fixed parity:

First Commonwealth Financial (FCF) to acquire GA Financial (GAF) for \$35 per share with payment prorated so that 40% is paid in cash and 60% is paid in FCF stock. Deal announced before market open on Dec 12, 2003. Number of shares of FCF to be paid will be determined during a pricing period before the completion of the merger.

- Trading strategy: Since \$14 ($=0.4 \times 35$) will be paid in cash and \$21 ($=0.6 \times 35$) will be paid in stock, we buy 1 GAF share at 34.50 at the close on Dec 12, 2003 and short \$21 worth of FCF shares in equal portions on each day of the pricing period. This will lock in an effective sale price for the GAF share at \$35, even if the price of FCF shares fluctuates between the end of the pricing period and the resolution of the merger.
- P/L analysis:

Potential profit	\$0.50 per share
Potential loss (assuming GAF returns to pre-announcement price)	-\$5.70 per share
Return on arbitrage position	1.4% if successful -16.5% if unsuccessful
Probability of merger success assuming no arbitrage	0.92

Real-Life Examples of Merger Arbitrage Positions

- Contrived example of stock bid with collar:

Company A to buy company B by effecting the following exchange:

Let:

S = the average price during the pricing period

H = high price specified in the merger proxy

L = low price specified in the merger proxy

Exchange every B share for:

α shares of A if $S > H$

$\beta = \alpha \frac{H}{S}$ shares of A if $L \leq S \leq H$

$\gamma = \alpha \frac{H}{L}$ shares of A if $S < L$

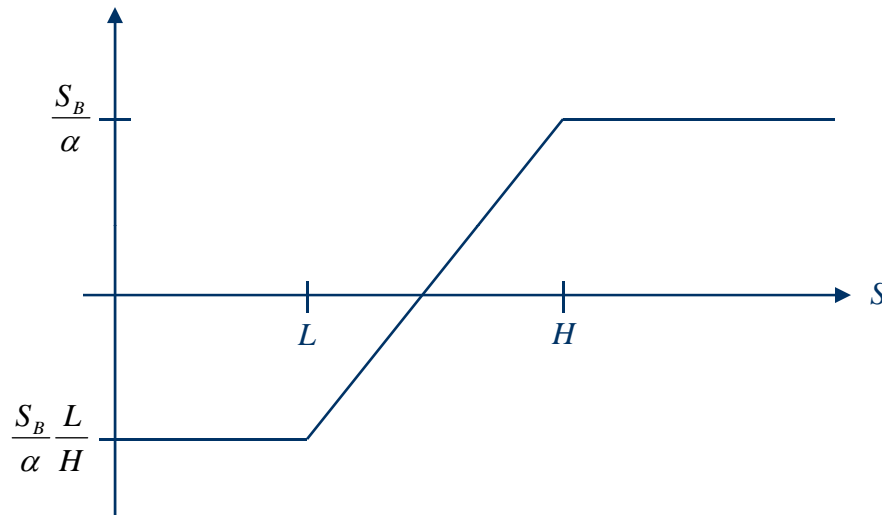
If S_B is the cost basis of a B share, then the equivalent cost basis S_A of the A shares received in exchange for the B share is:

$$\begin{aligned} S_A &= \frac{S_B}{\alpha} && \text{if } S > H \\ &= \frac{S_B}{\alpha} \cdot \frac{S}{H} && \text{if } L \leq S \leq H \\ &= \frac{S_B}{\alpha} \cdot \frac{L}{H} && \text{if } S < L \end{aligned}$$

Real-Life Examples of Merger Arbitrage Positions

- The payout diagram below shows the cost basis of the A shares received as a function of the average price S during the pricing period. This cost basis is capped from above and below.

Cost basis for A shares



- The expected value at time t of the merger consideration M to be received for each B share can be expressed as:

$$M(t) = -(\beta - \alpha) \cdot \text{Call}(H, t_1, t_2, \sigma_A, r, U) + \beta S + \gamma \cdot \text{Put}(L, t_1, t_2, \sigma_A, r, U)$$

where Call and Put denote the values of a call and a put respectively on A shares, t_1 and t_2 are the start and end dates of the pricing period, σ_A is the return volatility of A shares, r is the risk-free rate and U is the price of A shares at t . The optionality is of Asian type if the pricing period consists of several days. It is of European type if pricing period is one day.

Real-Life Examples of Merger Arbitrage Positions

- It is easy to check that:

$$\begin{aligned}M &= -(\beta - \alpha) \cdot S + \beta S = \alpha S && \text{if } S > H \\ &= \beta S = \alpha H && \text{if } L \leq S \leq H \\ &= \beta S + \gamma S = \alpha H \cdot \left(1 + \frac{S}{L}\right) && \text{if } S < L\end{aligned}$$

- Trading strategy: Buy 1 B share and short d shares of A where $d = \frac{\partial M(t)}{\partial U}$. This is a dynamic hedging strategy in which the number of shares of A held short is the delta of the option combination which is the merger consideration. Since d may change over time, the number of short A shares will have to adjusted periodically until the merger is completed to ensure that the arbitrage profit is preserved.
- A Monte Carlo package will be needed to compute the delta if the options are Asian.

Trading the Merger Spread

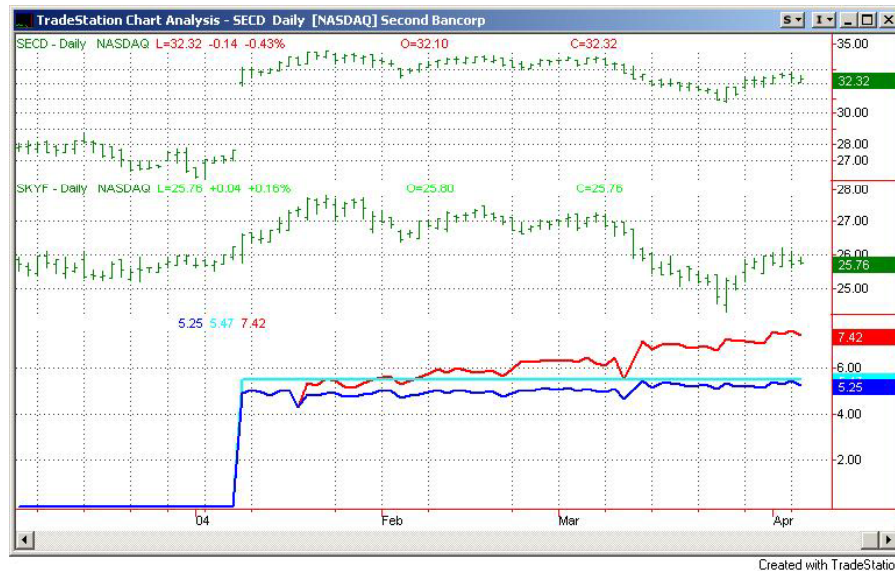
- It is a well-known mathematical fact that if a dollar cost averaging strategy is applied to an asset that is highly mean reverting, the resulting return stream will have a positive drift even if the asset itself does not rise at all.
- The dollar cost averaging strategy is simply to buy more of the asset when its price is lower and sell out some of it when its price is higher while maintaining a constant “core” position.
- We applied the same concept to trading the merger spread (i.e. the spread between the target company’s stock price and the acquiring company stock price multiplied by the exchange ratio).
- We double the merger arbitrage position when the spread is at or below its 5-day low (i.e. when the spread is considered cheap) and half the position when the spread is at or above its 5-day high (i.e. when the spread is considered rich). We always maintain a constant core position.
- In other words, if we have 1 unit of the spread as core, then we accumulate 1 more unit when the spread is cheap and sell out this unit when the spread is rich.
- The effect on the return of the merger spread is shown in the following graphs.

Trading the Merger Spread



The top price chart is that of the target and the middle price chart is that of the acquirer. The bottom chart shows the P/L if the merger is completed (light blue), the P/L of the constant core position (dark blue), and the P/L achieved by trading the merger spread using the simple strategy described (red).

The P/L of the core position is capped at the light blue line. However, if we trade the spread we can exceed this theoretical cap.

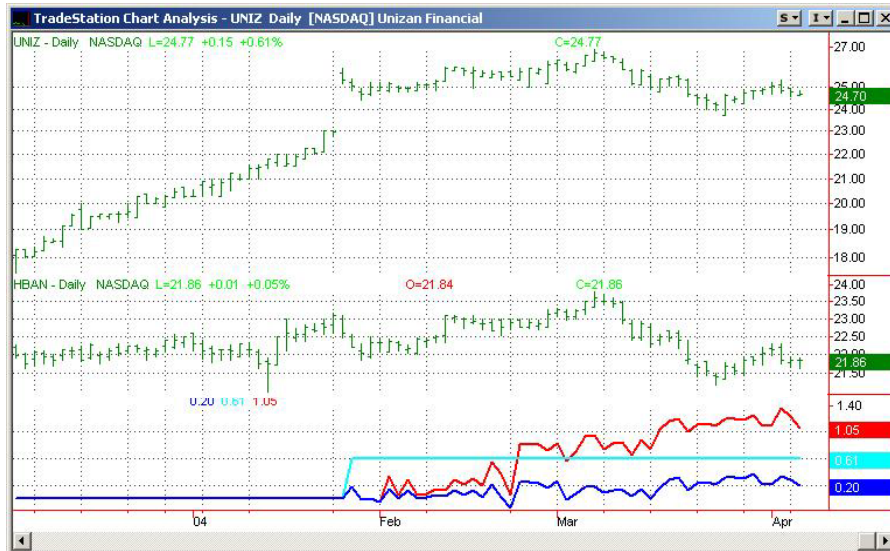


Trading the merger spread invariably enhances the yield of the position, sometimes by as much as two times. This is true of all the merger spreads in our portfolio at the current time.

Trading the Merger Spread



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More examples of yield enhancement from trading the merger spread.

In fact, one could do away with the core position all together and just trade the spread! This would reduce the exposure of the portfolio to deal failure since the spread position is not maintained all the time.

Miscellaneous Considerations

- There are several points to note with respect to the particular character of each arbitrage position and also to the portfolio of arbitrage positions as a whole:

The average merger deal takes 4 months from announcement to complete. This means the “annualized” return from each position is 3 times the return of the position.

Friendly takeovers are more likely to succeed than hostile ones. About 3% of friendly bids are busted.

Will bidder be borrowing heavily to finance deal? If so, will target back out of deal?

If the takeover is hostile, does target have sufficient legal and strategic defenses? Can bidder finance the transaction? Is there is “white knight” (even higher bidder)?

Theoretically speaking, the portfolio of arbitrage positions is short a diverse basket of improbable but highly calamitous event risks (the risk of deal breaking). Is there a situation in which these normally diverse event risks become correlated? If the stock market suffers a big downturn and many acquirers’ stock drop significantly, will the rate of deal failure increase significantly because many targets back out of their deals?

- The risk-adjusted return of a merger arbitrage strategy may be improved through the judicious use of options in individual arbitrage positions. Stock index options may also be used to protect against a stock market crash.