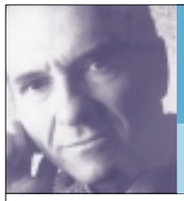

Ed Thorp

A MATHEMATICIAN ON WALL STREET

Statistical Arbitrage – Part II

In the late 1970s affordable, powerful computers and high quality databases were becoming more affordable, making a revolution in Finance possible

"The harder I work, the luckier I get." –
Alan (Ace) Greenberg, Chairman, Bear Stearns.

Why do we (and others) call it statistical arbitrage? Arbitrage originally meant a pair of offsetting positions that lock in a sure profit. An example might be selling gold in London at $300 an ounce while at the same time buying it at, say $290 in New York. Suppose the total cost to finance the deal and to insure and deliver the New York gold to London is $5, leaving a $5 sure profit. That's an arbitrage in its original usage. Later the term was expanded to describe investments where risks are expected to be largely offsetting, with a profit that is likely, if not certain. For instance, to illustrate what is called merger arbitrage, company A trading at $100 a share may offer to buy company B, trading at $70 a share, by exchanging one share of company A for each share of company B. The market reacts instantly and company A's shares gap to, say, $88 while company B's shares jump to $83. Merger arbitrageurs now step in, buying a share of B at $83 and selling short a share of A at $88. The deal is expected to close in three months and, if it does, the arbitrageur will (without leverage) make $5/$83 or 6 per cent in three months, a simple interest annual rate of 24 per cent. But the deal is not certain until it gets regulatory and shareholder approval, so there is a risk of loss if the deal fails and the prices of A and B reverse. If, for instance, the stocks of A and B returned to their pre-announcement prices, the arbitrageur would lose $12=$100-$88 on his short sale of A and lose $13=$83-$70 on his purchase of B, for a total loss of $25 per $83 invested, or a loss of 30 per cent in three months, a simple annual rate of −120 per cent. For the arbitrageur to take this kind of risk, he must believe the chance of failure to be quite small.

What we do has the risk reducing characteristics of "arbitrage" but the two hundred or so stocks in each of the two "sides" of the portfolio, the long side and the short side, are generally not "related" or "linked" to each other. We depend on the statistical behavior of a large number of favorable bets to eventually deliver our profit. This is card counting at blackjack again, on a much larger scale. Our average trade size, or "bet," is $54,000 and we are placing a million bets a year, or about one bet every six seconds that the market is open.

As I walk back to my office I think about how our statistical arbitrage venture came to be.

I first met Steve about 1970 when I was a mathematics professor at the University of California at Irvine and he was a double major in Physics and Computer Science. Steve and a friend did an imaginative special studies summer research project using a computer to study blackjack, under my guidance. Then in 1973 when Princeton-Newport Partners was expanding, I remembered Steve fondly and, fortunately, he was one of the first people I hired. Able to solve difficult problems in both computer hard-

ware and software, Steve's smart, hardworking understated manner earned his reputation in our firm as "the man who can do anything."

The Indicators Project and the Discovery of Statistical Arbitrage

By 1978 I had moved from the mathematics department to the Graduate School of Management at UCI, which enabled me to teach courses in finance. After many stimulating discussions with Dr. Jerome Baesel, the professor in the next office, he came to work full time at Princeton-Newport Partners. A major responsibility was to direct research on an idea of mine which we called the indicators project. Neither Jerry nor I believed the efficient market theory. We had overwhelming evidence of inefficiency, i.e. systems that worked, from blackjack, to the history of Warren Buffett and friends, to our daily success in Princeton-Newport Partners. The question wasn't "Is the market efficient?" but rather "How inefficient is the market?" and "How can we exploit this?"

The idea of the indicators project was to study how the historical returns of securities were affected by the values of various indicators or characteristics such as the P.E. ratio, the book to price ratio, company size or market value, and scores of other fundamental and technical measures. Now this is a well-known and widely explored idea but back in 1979 it was daring, innovative, and with few exceptions roundly denounced by the massed legions of academia. The idea was timely because the necessary high quality databases and the powerful new computers with which to explore them were just becoming affordable.

By luck, almost immediately after we began the indicators project at the end of 1979, one of our researchers stumbled on the germinal idea for statistical arbitrage – a single indicator that ranked stocks from best to worst and offered a short-term forecast of their performance compared to the others. The idea was to rank stocks by their percentage change in price, corrected for splits and dividends, over a recent past period such as the last two weeks. We found that the stocks that were most up tended to fall relative to the market over the next few weeks and the stocks which were the most down tended to rise relative to the market. Using this forecast our computer simulations showed approximately a 20 per cent annualized return from buying the "best" decile of stocks, and selling short the "worst" decile. We called the system MUD for the recommended portfolio of "most up, most down" stocks. As my friend U.C.I. mathematician William F. Donoghue used to joke, little realizing how close he was to a deep truth, "Thorp, my advice is to buy low and sell high." (He had the habit of calling even close friends by their last name.) The diversified portfolios of long and short stocks had mostly offsetting market risks so we had what we liked - a market neutral portfolio. But the total portfolio, even though it was approximately market neutral, suffered from moderately large random fluctuations. Spoiled by the continuing low risk and high return performance of Princeton-Newport Partners, we put statistical arbitrage aside for the time being.

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Unknown to us, in 1982 or 1983 an ingenious researcher at Morgan Stanley invented another statistical arbitrage scheme with characteristics like ours but with substantially less variability. His project probably began trading real time in 1983. As his confidence increased with experience, it expanded in size. By 1985 it was a significant profit center at Morgan Stanley but the credit for its discovery, and the rewards from the firm, reportedly did not attach to the discoverer, Gerry Bamberger. While his boss Nunzio Tartaglia continued to expand the operation with great initial success, a dissatisfied Bamberger chose to leave Morgan Stanley.

The Money Machine Begins Operating

In 1985, as part of our business plan to add diversified "profit centers," our Princeton office placed an ad saying Princeton-Newport Partners was seeking to bankroll people who had successful low risk market neutral quantitative strategies. Bamberger, now out of a job, was one of those who answered the ad. He described his strategy as high turnover, market neutral, and low risk, with a large number of stocks held long and a large number held short, at any one time. It sounded very much like our unused statistical arbitrage strategy, so even though we only knew the general characteristics of the portfolio, and none of the details of the trading algorithm, we had no difficulty believing the story. After we checked Bamberger's background, I met with him in Newport Beach. Following lengthy negotiations, he told me how the strategy worked, once I gave my word that I would tell no one else unless either he okayed it or the information entered the public domain by some other route.

Gerry Bamberger was a tall trim Orthodox Jew with a very high IQ, an original way of looking at problems in finance, and a wry sense of humor. He spent several weeks working with us in Newport Beach. After a few days I noticed that Gerry always brought a brown bag for lunch and always ate a tuna salad sandwich. I finally had to ask, "How often do you have a tuna salad sandwich for lunch?" Gerry said, "Every day for the last six years." He was a heavy smoker and I'm extremely sensitive to tobacco smoke - we did not hire smokers nor allow smoking in our office - so part of our negotiation was about how to handle this. We respected each other and worked out a compromise that met each of our needs. Whenever Gerry needed a cigarette he would step outside our ground floor garden office. This is not the ordeal in Southern California that it could have been during an east coast winter.