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A MATHEMATICIAN ON WALL STREET

# Statistical Arbitrage - Part V

This issue we continue our discussion of haggling using our house example

Suppose the seller's real lowest price is \$260,000 and that the highest price the buyer is really willing to pay is \$290,000. (The seller might find out, for instance, that the buyer will really pay \$290,000 by reporting that he has another offer at \$289,000, at which point the first buyer offers \$290,000.) Thus any price between \$260,000 and \$290,000 is acceptable to both parties, even though neither party knows this at the time. So \$30,000 is "up for grabs." The objective of the haggle is to capture as much of this \$30,000 as possible for one side or the other.

On the other hand, if instead the buyer is only willing to go to \$270,000 and the seller's (secret) lowest price is \$280,000, there is no overlap, no price both will accept, and there will be no deal.

Just such a haggler determined where I lived for 20 years. We had decided to make a local move and had located a spectacular view lot high on a hill in Newport Beach. In the depressed 1979 real estate market it was offered at \$435,000. We started at \$365,000 and after a series of offers and counter offers, we eventually offered \$400,000, which was countered at \$410,000. We countered at \$405,000, our absolute limit. Rejected. We walked. A few days later the seller relented and offered to meet our \$405,000 price. But we didn't accept. Why not?

At our absolute limit, we were almost indifferent as to whether we did the deal or not. Meanwhile the seller had now alienated us, and we preferred not to have any further dealings with him. Consequently his deal was less attrac-



tive and our top price now dropped below \$405,000. And, we had begun to consider attractive alternatives. We soon bought a better lot, built a new house, and spent 21 happy years there. The haggler's lot remained unsold for another decade.

Ironically, when we recently sold this house, we had another example of the losing haggle. After a year on the market we suddenly got two offers the same weekend. We were asking \$5,495,000 and expecting to get about \$5,000,000. One offer was at \$4.6 million and the prospective buyer used his aggressive business partner to open negotiations. The partner's in-your-face quarrelsome style and nitpicking criticism of the house was designed to beat down the price. He alienated us and our agent. The other offer was for \$5 million from an agreeable family who loved the house "as is." We accepted, upon which the other buyer begged us to reconsider, indicated he would meet or exceed the other price, and wouldn't use "in-your-face." Too bad. So they were relegated to being a back-up offer for the next two months in case our buyer dropped out. He didn't. Lesson: it doesn't pay to

push the other party to their absolute limit. A small extra gain is generally not worth taking the substantial risk the deal will break up.

## A Lesson for traders?

Knowing when to haggle for a small extra gain and when not to is valuable for traders. Let's look at an example that could help you in your trades whether in the market or elsewhere.

In the days of Princeton-Newport one of our head traders used to crow about how, by regularly holding out for an extra eighth or quarter he saved us large amounts of money in the long run. Here's the idea. Suppose we want to buy 10,000 shares of Microsoft (MSFT), currently trading at, say, 71 bid for 50,000 shares, and  $71\frac{1}{4}$  asked for 10,000 shares. We can pay  $71\frac{1}{4}$  now and buy our 10,000 shares. Or, as our trader would do, we can offer to buy our 10,000 shares at  $71\frac{1}{8}$  and see if we have any takers. If this works, and it does most of the time, we'll save  $\frac{1}{8} \times 10,000$  or \$1,250.

This sounds good. Is there any risk? Yes. To see why, notice that we fail to save  $\frac{1}{8}$  per share only when the stock always trades at  $71\frac{1}{4}$  or higher for however long we're trying to buy. All

those stocks we miss out on have moved higher and some of them have run away to the upside. Those runaways would have given us windfall profits. Put simply, you might scalp  $\$ \frac{1}{8}$  twenty times and lose a \$10 gain once. Do you like that arithmetic? I don't.

I asked our Princeton-Newport trader how he could tell whether his scalping profits offset his losses from missed opportunities. He could not make a case for what he was doing. I asked other traders around the street the same question and didn't find anyone who could clearly show that they gained more than they lost by scalping for eighths. But financial theory can give us some help here.

Markets are basic to modern economics and trading is the fundamental activity. Modern financial theorists have, therefore, intensively analyzed how markets work, both by analyzing data and developing theories to explain what they observe. They note that trades are initiated for a variety of reasons. Some of the initiators have no edge – no special advantageous information – probably including most of the people who do think they have an edge. Examples of these so-called noise traders might include an index fund selling a company because it was dropped from the index, or buying a stock that was added to its index, or an estate liquidating to pay taxes, or a mutual fund buying or selling in response to cash additions and withdrawals. Of course, to the extent some worthwhile information is used in any of these trades, our examples are imperfect.

The other type of trade is initiated by traders who do have an edge. Examples might be the illegal insider trades made famous by the prosecutions of Ivan Boesky and others in the 1980s, and which continue to this day, or the legal trades made by those who act first on public information – an earnings announcement, a takeover, an interest rate change, etc.

Does all this really matter? What's an eighth of a dollar a share? For Ridgeline Partners, trading one and half billion shares a year, it can add up. As President Lyndon Johnson once said about congressional spending, a billion dollars here, a billion dollars there, and pretty soon you're talking about some real money.

## Satisficers versus maximizers

The behavior of the hagglers and the traders reminds me of the behavioral psychology distinction between two extremes on a continuum of types: satisficers and maximizers. When a maximizer goes shopping, looks for a handyman, buys gas, plans a trip, etc. he or she searches for the best possible deal. Time and effort don't matter much. If they miss the very best deal they feel regret and stress. On the other hand, the satisficer factors in the costs of searching and decision-making, as well as the risk of losing a near optimal opportunity and perhaps never finding anything as good again. This is reminiscent of the so-called secretary problem in mathematics.

Assume that you will interview  $n$  candidates, from which you can choose only one. You must consider them one at a time and having once rejected a candidate you cannot reconsider. Assuming that, *ex post*, they have desirability ranks from 1 to  $n$  with  $n$  being best, what *ex ante* strategy maximizes the probability of choosing the best? The well known answer is that after seeing a fraction  $f(n)$  (which tends to  $1/e$  as  $n$  increases) of the candidates you should choose the next one (if any) whose rank exceeds those already seen. Instead of trying for the very best a satisficer might choose to solve an alternate version of the problem: maximize the expected rank (or, more generally utility) of his choice. The secretary problem has many such variations and has been intensively studied by mathematicians. It is part of the theory of optimal stopping and a google search on "secretary problem" (exact phrase) will turn up many interesting articles.

As mentioned earlier, I had discontinued discussions of a joint venture in statistical arbitrage with an endlessly haggling hedge fund general partner. Meanwhile, another group was interested. They were a financial engineering firm of about twenty people and we knew the principals from Princeton-Newport days. I proposed that we jointly build a new Princeton-Newport style hedge fund. We would provide the investors and the investment capital, the roadmap, the key software, and the overall direction and guidance. For this we would own a permanent share. Their organization would implement everything with our help, and eventually they would be running

operations with our guidance and participation in decisions.

My business plan, based on the proven Princeton-Newport model, was to start with statistical arbitrage as a core profit center. After establishing that foundation for the business we would add as the next profit center convertible bond, warrant, option and other derivative hedging for which we still had cutting edge experience and computer software. Then we would expand into other areas I knew how to implement.

The venture began auspiciously. Our statistical arbitrage software ran smoothly, first in simulation and then with real money, starting in August of 1992 with a managed account for a large institutional investor. We had an enormous idea backlog which we eagerly anticipated leveraging through our associates to make the model more powerful. Months passed and the pace of research and development seemed negligible. We had continual trips, meetings, memos and telephone calls. My beautiful ideas were rotting on the vine for lack of follow through. It was clear that if I wanted significant research and development we would have to do it "in house."

Steve and I hired an outstanding C++ programmer and as we worked together, research output in our office spurted. It was easier and quicker to do everything ourselves than to continue with our associates. We licensed them to use the 1994 version of our software and went our separate business ways. Meanwhile, my friend Frank Meyer (founder of the Glenwood fund of funds, later merged into Mann-Glenwood), along with the young quantitative investment genius Ken Griffin who Meyer had discovered trading from his Harvard dorm, was building a hedge fund to which I offered early advice and encouragement, using the same business plan I had proposed to our ex associates. In ten years Griffin's market neutral Princeton-Newport style hedge fund operations – The Citadel Group – grew to \$4.3 billion under management with annualized returns averaging more than 30 per cent and some 320 employees. It now stands at \$11 billion with over 800 employees, one of the most valuable hedge fund franchises in the world. Our ex associates had blown off the chance of a lifetime.