
# THE FINAN-SEER

## BY E. L. LOCKE

The speaker went on. And on. And on. ". . . I want to remind you that I am the only real business man among you. I am the only one here that ever met a payroll and so I know just how to handle this situation. Now when I was running my butcher shop in Carteret, New Jersey, I found ways and means to keep my business solvent. I tell you it was a tough job because it was a credit store and you should have seen how many of my customers were deadbeats. I—"

A quiet but sarcastic voice cut in, "I don't doubt that the Professor of Meat Cutting was able to devise ways and means. After all, I understand the high incidence of corpulence among butchers is not entirely accidental. Large stomachs have their uses in the weighing process."

A beet-red color suffused the face of the first speaker and strangling sounds came out of his throat. Before he could collect himself to retort, a silver-haired, dignified-looking man got up from the head of the

Illustrated by Cartier

*When professors try tackling the Wall Street professionals, a good job of trimming is to be expected. But in a way, this is a* deus ex machina *story, at that—*

conference table and said: "Gentlemen, let us stop this bickering. Your remarks, Professor Bronson, were uncalled for, and I think you owe Professor Schultz an apology. On the other hand, I am afraid that Professor Schultz's business experience is not precisely the type that will extricate Trent University from its troubles. Let us review the problem briefly and see if this time we can get some constructive suggestions.

"The roots of our problem extend back several years. Our endowment fund at that time was invested entirely in government and utility bonds. The steady decline in interest rates forced our trustees to seek higher yields. Since a number of them belong to . . . ah . . . the financial fraternity, they convinced the other trustees that the thing to do was to invest in common stocks."

At this point he was interrupted by the physicist, Professor Andrew James. He was an unusually young man to hold a full professorship, being still in his middle thirties. He held the newly created chair of Applied Physics in tribute to his abilities as an idea man who had established a solid reputation in industrial work. He asked: "What was wrong with that, Dean Fairbanks?"

"Why nothing, Professor James, as a matter of principle. The income was raised quite appreciably—for a time, that is. Then we were hit by what appeared to be a minor recession, and then the trouble started."

Professor James interrupted again: "I thought these Wall-Streeters knew all the ins and outs. Why didn't they sell short?"

"The answer to that is that their statisticians told them that a turn was coming and so they hung on. As a matter of fact, our Department of Economics was consulted. I understand that they arrived at the same conclusion after applying the best mathematical techniques. Why, I believe that they analyzed the past performance of the market by applying the theory of Fourier Series, and then extrapolated the result." He added wryly: "The results were rather unfortunate.

"Then, in desperation, the trustees started to . . . er . . . switch, I believe they called it. However, their steps were dogged by misfortune. Recently I was informed that unless the university can recoup its losses, we shall be forced to curtail our operations. I therefore called this meeting of the faculty to see if there were any ideas for extricating our

university from its financial morass." Then he added with a wan smile on his face, "After all, gentlemen, college professors are popularly believed to be profound thinkers. Let us at least make an attempt to validate that belief."

Professor James spoke up again: "Suppose that we do come up with a solution. What guarantees have we that the trustees will not reject our solution as the impractical dreamings of 'long hairs'?"

The dean looked thoughtful for a moment before replying: "I do not want to trespass in the domain of our colleagues in the Department of Applied Psychology, but it did appear to me that our trustees are in such a desperate position that they will clutch at any solution. Then he smiled a bit and continued, "I can just see the headlines in our sensational press. 'BROKERS BREAK COLLEGE.' You can imagine what that would do to the fast vanishing reputation of financiers for astuteness."

A mild-looking man of slight build, apparently in his fifties, spoke up rather hesitantly, "I must say that I am disappointed that my friends in Economics thought that Fourier Series were appropriate to this sort of problem. I had the impression that Economics was not an exact science and that the mathematical techniques used were rudimentary, but it does shock me a bit that they were that naive."

The mathematician had addressed his remarks to Professor Johnsrud of Economics. The latter was a large man who secretly cherished a slightly physical resemblance to the late J. P. Morgan. He had often felt that the resemblance was more than one of appearance. Given a slightly different set of circumstances, he often reflected, he could have matched Morgan's financial achievements. Thus, though he was a man of undoubted ability, he tended to overestimate it and was quick to resent any apparent slights. Accordingly, he jumped to his feet and spoke with considerable asperity: "Newcomb, I believe that someone, a mathematician no doubt, once claimed that God must have been a mathematician. You mathematicians have never forgotten that. Let me remind you that the converse of that proposition is not true. It is easy to be wise after the event. What would you have had us use?"

"My dear Johnsrud, I did not intend to hurt your feelings. It does seem to me that you might at least have used the Theory of Stationary Time Series. In the last war the theory was well developed in connection with the problem of predicting the future position of enemy aircraft, when the data on its present position was distorted by extraneous disturbances."

Johnsrud was still sulking when he asked: "And how far ahead were they able to predict with this wonderful mathematical tool?"

"Oh, about two seconds, if my memory serves me correctly."

Johnsrud smiled in a superior manner, slowly swept his glance around the conference table and merely said: "I thought so."

"That does not invalidate the principle of the thing. I want to add that since then we have acquired an even more potent attack on just such problems. I am referring to the book by Morganstern and von Neuman, 'Theory of Games and Economic Behavior.' It seems to me that we should exploit the possibilities of this viewpoint."

Professor James spoke up: "The last part of the title seems as though the material may be apposite. Can you tell us a little something about it, Professor Newcomb?"

"I am afraid that anything I can say at the moment would not convey an adequate impression of the depth and scope of the method. Briefly, in most games and, of course, in all business deals, the opponents have incomplete information. For the sake of simplicity let us say that there are only two players. Player A has a number of courses of action open to him at any given stage. For any specific course he knows that his opponent B has the choice of a number of replies. A then calculates what his chances are for any one of the possible replies B can make. A then assumes another of his possible courses of action and again calculates his chances for all possible replies B can make, et cetera. Of course, B is assumed to be doing exactly the same thing. Each player can, on the basis of his calculations, use the strategy that makes his probability of winning a maximum. Is that clear, Professor James?"

"Not exactly. Can you give a simple example?"

"Yes, I believe I can, if I may have the use of the blackboard. This example was devised at Princeton precisely for the purpose of providing a simple illustration of the principles involved. Assume that each of two players has a red ace and a black ace: A also has a black deuce and B a red deuce The players match cards for color. The rules are that if the chosen cards have the same color B pays A and vice versa, except that, if both cards are deuces, it is a draw, and if both cards are aces, payment is one unit; with ace against deuce, two units. The scheme of payments is shown in the table I am now putting on the blackboard."

| | | Black ace | Red ace | Red (B) deuce |
|---|---|---|---|---|
| | Black ace | 1 | −1 | −2 |
| (A) | Red ace | −1 | 1 | 1 |
| | Black deuce | 2 | −1 | 0 |

"For instance, if A plays his black ace and B does likewise, A wins a point; if on the other hand B should play his red ace or his red deuce, A pays B one or two points, respectively. Suppose that this game goes on for a long time, what do you think the strategies of the respective players will be, Professor James?"

"I would say offhand that the play should be at random, since the table indicates that this is a perfectly fair game."

"You are mistaken, Professor James. This is a crooked game, despite appearances. With the best strategy B can devise, assuming that A does likewise, B will lose a fifth of a point per game in the long run. A's best strategy is to play his red ace three fifths of the time, his black deuce two fifths of the time, and his black ace not at all. On the other hand B should play his black ace two fifths of the time, his red ace three fifths of the time and not play his red deuce at all. Of course, the real problem is how to find these fractions."

He turned toward James whose face wore a puzzled look, and continued: "Maybe it would be better if I showed you how it works out for the random play you suggested. Suppose A thinks his best strategy is to play each of his cards one third of the time. Suppose he guesses that B will play the black ace. If A plays the black ace, he will win one third of a point. If he plays the red ace, he loses one third. Finally if he should play his black deuce, he wins two thirds of a point. Thus on the assumption that B plays the black ace, A's long run expectation is a win of two thirds of a point per game. But remember, B may not be playing at random. If B should play his red ace, the same type of calculation shows that A's expectation is now a loss of one third of a point. Similarly if B plays the red deuce, A again stands to lose one third of a point. Now A has the right to assume that B will try to play as intelligently as possible. It follows then that if A plays at random and B plays intelligently, A can expect to lose one third of a point on the average. What A has to do is to figure out his line of play so that the smallest of his expectations, no matter what B does, is made as large as possible. It turns out that the best strategy for A is that which I first mentioned, namely zero, three fifths, and two fifths. Of course B can do a similar calculation but he finds to his sorrow that his best strategy, namely, two fifths, three fifths and zero still loses one fifth of a point per game."

Johnsrud had listened carefully but nevertheless managed to sound bored as he spoke up: "This is all very interesting, no doubt, but how is this to help us? Did you have in mind that the university should send us to participate in floating crap games?"

Newcomb smiled and said: "You know, that never occurred to me. Maybe it isn't such a bad idea. What I had in mind was that you could figure out a way to apply this to operating in the stock market. You know the various factors that enter into stock movements, and I thought you could list these factors and make up the required matrix." Then he added rather plaintively, "At least I assumed that you could do it."

Johnsrud rose to the bait and snapped out: "Certainly I can do it. But it seems to me that you can not make a big killing in the market with

this scheme, and that is exactly what we need to do."

Professor James cut in at this point: "Are you quite sure that that is a necessary assumption? It seems to me that our real trouble is that the loss in dividends has cut into our income. Therefore, I think that all we need to accomplish is to win an amount which is equivalent to the normal yield of the stocks."

"Well, perhaps you are right, Professor James. I shall get to work at once and set up the matrix. Why I can think of dozens of factors right now that would go into it and I don't doubt that when I buckle down to work I may find as many as several hundred." Then his face did a double take. "Something just occurred to me. From the example you gave, it seems to me for a complicated problem a lot of computing will be necessary. Who will do this work, Newcomb, and how long will it take to solve for the best strategy?"

"I must confess that I had not given that phase any thought. I assumed that the two computrices we have in our Statistical Laboratory could do it on their Monroes. As to the time required, let me think. If the matrix is MxN, there is an $M^{+}N$ fold infinity of combinations to be tried, but, of coures, we have to worry only about our end. That reduces to an M-fold infinity which should help a lot. Then I have in mind certain theorems which would permit us to converge on a solution. All in all, I should say it would take several years of computation."

The answer left Johnsrud thoroughly exasperated and his tone showed it. "You propose a scheme that will take several years to evaluate the strategy for a single day's operation! It is now my turn to say that while I knew that mathematicians were naive I did not think that they were that naive."

Professor James stepped in again at this point: "Really, gentlemen, there is no need for recrimination. I believe there is a way out of this. As I see it, you, Professor Johnsrud, agree that the idea is basically sound and the only problem is to get the computation done quickly. Why not make use of the electronic calculator our department is working on? I believe it is now being de-bugged and should be ready for use soon."

"I must admit," said Newcomb, "that the use of a machine had not occurred to me. I don't believe in them, you know, at least not for mathematics. However, in the case of necessity, such as now existing, I should remain open minded."

Dean Fairbanks had been following the argument with intentness. When he saw that three of the best men were in essential agreement, he thought that the matter had better be acted on at once. So he rose to his feet and said: "Gentlemen, it begins to look as if a possible solution has been uncovered. I suggest, therefore, that Professors Johnsrud, Newcomb, and James constitute themselves a committee to act on this proposal. Let me know when you have worked out a *modus operandi*,

and I shall take up the matter with the trustees. As I intimated before, there shouldn't be any difficulty on this score. Now unless someone else has a comment to make, I shall adjourn the meeting."

Excerpt from Shell's column in the New York *Tabloid,* November 2nd.

This scribe has heard that a certain university, not so far from here, is in financial difficulties, the trustees having lost the university's shirt in the stock market. It is now rumored that the long hairs have taken matters into their own hands. They have cooked up a scheme to play the market with the aid of a mechanical brain. The wolves of Wall Street are said to be licking their chops in anticipation. Will someone kindly have a barrel ready for our long-haired friends?

Excerpt from Shell's column in the New York *Tabloid,* February 17th.

It was this scribe who first tipped you off that a certain university was going to try its luck in the stock market with a mechanical brain. The brain, which has been named "ANDROID"—to you lugs, A Numerical Dopester Robot; Operations Investigated and Developed—is apparently a lot smarter than the Street credited it with being. Your scribe has heard that it has been taking the Market to the cleaners to the tune of two hundred Gs a day. Save that barrel, the wolves may need it.

Professors Johnsrud, Newcomb and James marched into Dean Fairbanks' office. He waved them to chairs and after they had settled themselves, said: "I called you together so that we could review our recent operations in the stock market. It is almost time for my report to the trustees, and I wish to be well armed with facts."

Professor Johnsrud glanced at his colleagues and interpreted their silence as an invitation to act as spokesman. He cleared his throat and said: "If you had asked that question yesterday, I would have said that our operations are completely successful. Today, I am not quite so sure."

The dean's raised eyebrows prompted him to continue. "You see, Fairbanks, since the machine operates on a probability basis, a plot of our operations against time is not a smooth curve. We have a winning run, followed by a losing one and so forth. Of course, the integrated effect of our operations is easily known. All that we need to do is to look at our running profit and loss account. This shows that our average daily profit has been about twenty thousand dollars a day."

The dean interjected, "I was aware that you have done very well. In fact our financial embarrassment is a thing of the past. Just why are you worried, Johnsrud?"

"I am not really worried. It is Newcomb who thinks that we are in trouble. Perhaps he had better tell you about it."

"You may remember that, when we first considered our financial difficulties, I pointed out the existence of a mathematical technique

known as the 'Theory of Stationary Time Series.' I mentioned that it was used as a means of predicting the mean trend of fluctuating phenomena. Out of curiosity, I applied this theory to the data of our day to day operations. I calculated the auto-correlation function and if I interpret it correctly, our mean trend has reversed. On the basis of this I think we shall lose a considerable sum unless we act at once."

The dean turned to Johnsrud. "I take it that you are not in full agreement with Newcomb's views?"

"That is right. There may be something in what he says. I would not care to reject his findings outright. If there is one thing that my years of experience with economic phenomena have taught me, it is to look out for the unexpected. However, I find it difficult to share Newcomb's pessimism because, after all, just look at our comfortable bank balance. Besides, I'm sure my matrix takes every important factor into account. I therefore suggest that we let matters go on for the present and see if this trend really shows up."

The dean turned to James. "Do you have any definite views on this matter?"

"No, I can't say that I have. I have no physical intuitions concerning it. While I have a lot of respect for mathematics, I still have a vague distrust for statistical methods, except of course, in Quantum Mechanics."

"In that case," said the dean, "suppose we wait and see. Good day, gentlemen."

Excerpt from Shell's column in the New York *Tabloid* April 1st.

News has reached this scribe's ears that the battle of wits has turned against Android. The super-brain has been taking a shellacking from the wolves. Does anyone here want to buy a certain university cheap?"

It was late in June and the campus seemed deserted except for a pair of men walking slowly, engaged in conversation.

"Whatever gave you the idea, James, to do what you did? If I may say so, it was a masterpiece of reasoning."

"Thanks, Newcomb, but I really can't claim that it was pure reason. Actually it was something in my subconscious that put the factors together. Are you familiar with Heisenberg's Uncertainty Principle?"

The older man nodded. "Yes, but what does that have to do with it?"

"Just this. Your use of the Stationary Time Series theory predicted that we were going to lose our shirts. Later events amply justified your predictions. I was mulling over our troubles and was getting nowhere in finding a solution. Just to relax and turn my mind into other channels, I picked up a text on Quantum Physics and started reading. I happened to open to the chapter on the Uncertainty Principle. There was a description of that old problem, the determination of the position and velocity of an electron,

using a radiation probe. You know the answer to that one. The radiation reacts with the electron and gives it a kick."

"I think I see. You mean that our machine was perturbing the market?"

"Exactly. I then searched through our matrix and found that we did not include a factor for the perturbing effect. Since we felt that our operations were on a relatively modest scale, it did not occur to any of us that such a factor should be included. However, the newspaper publicity exaggerated the effectiveness of our machine. I believe Shell, the news columnist, claimed our winnings to be two hundred thousand dollars a day. Actually it was about a tenth of that amount. As a result, professional market operators formed pools more frequently than normal, and this had the effect of introducing new factors for which we had made no allowance.

"The answer was obvious. All I had to do was to punch into the memory a set of instructions that the matrix should be modified by the machine itself, so as to make the predicted auto-correlation function positive. However to make the machine's job easier, I included a new row and column in the matrix to take care of the Shell effect. And that is all there was to it."

"That may be, James. I still feel that it was a great idea. Our troubles are over now."

"Yes, and now that we are on sound financial ground, we should pull out of the market rather soon. We shall have to do it in any case, within say six months. I suppose you have heard what is happening?"

"No, I don't think so."

James chuckled a bit and said: "It is a perfectly natural thing. We have built a better mousetrap and the rest of the world is copying our design. Several groups of operators have placed orders for their own electronic calculators. When these are delivered, we shall no longer have an advantage. If we should still be in need of money, maybe we shall have to take up Johnsrud's suggestion and play the floating crap games." He paused a moment and added in great good humor, "An idea just came to me. How would you like me to fix you up with a miniature transceiver, disguised as a hearing aid? We could send you to participate in those floaters. The players' bets would be picked up by the vest microphone and the machine would feed you the betting odds through the earpiece. Just think what a wonderful setup it would be! No? Well, I suppose not. To change the subject slightly, there is something that still bothers me. You remember that three-card game you used as an illustration?"

"Yes. What about it?"

"Just why is that a crooked game?"

THE END