

# Playing the Odds

## Computer Formulas Are One Man's Secret To Success in Market

### Hunches, Analysts' Reports Are Not for Ed Thorp; He Relies on Math, Prospers

#### 'I Call It Getting Rich Slow'

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NEWPORT BEACH, Calif.—For relaxation, mathematician Ed Thorp likes to play a quick game of blackjack with his Hewlett-Packard 9830 computer, which "deals." More often than not, he wins because he uses a system he developed in the early 1960s to beat the house at the popular casino game.

Mr. Thorp, who teaches courses in probability and functional analysis at the University of California at Irvine, also has winning strategies for such other games of chance as baccarat, faro and roulette.

But in the past decade, the lanky, 42-year-old professor largely has deserted the gaming tables to concentrate on the supreme game of them all—the stock market. "From a mathematical standpoint, the market is far more interesting than other forms of gambling because of the enormous number of variables and imponderables it encapsulates," Mr. Thorp declares. "Besides, the bulk of the past thinking about the market is nothing but alchemy and astrology."



Mr. Thorp's interest in the market is more than academic, however. For he claims to have found a mathematically based stock-trading system that not only consistently outperforms the various popular market indexes but also yields handsome profits whether the market rises or falls.

#### Accumulating a Fortune

Using the system, he has accumulated a tidy personal fortune starting with an initial stake of \$25,000 in Las Vegas gambling winnings in 1965. Moreover, he contends that a private investment pool that he started managing in late 1969 and that has since grown to about \$20 million has outperformed all but one of the more than 400 mutual funds tracked by Standard & Poor's mutual-fund guide. "The better one was one of those crazy funds invested in only gold stocks," he says.

Because of regulatory restrictions, he declines to disclose the exact performance figures of the two private investment funds in the pool. However, reliable brokerage-house sources close to the funds say they have averaged better than 20% a year in net asset growth, an enviable record considering the general market decline during the period.

Mr. Thorp's basic investment strategy is hedging, or stock arbitrage—a highly sophisticated form of trading long practiced by a small group of Wall Street specialists. It involves taking advantage of temporary discrepancies, or "anomalies," between the prices of related securities by buying one and selling the other. The game is played most frequently with common stock and securities convertible into them, such as convertible bonds, warrants, convertible preferred stock and options. It is a conservative strategy in which the risk of individual positions is minimal.

#### How It Works

A hedger's success rests on his ability to identify convertible securities that are underpriced or overpriced relative to the underlying stock. If the convertible is underpriced, a hedger buys it, and if it is overpriced, he sells the convertible short, taking care to hedge his bets by taking the opposite position in the underlying stock. The profit comes from the tendency of a position in the underpriced convertible to rise more or drop less in price than the related stock and a position in an overpriced convertible to rise less or drop more in price than the stock.

While hedging isn't new, Mr. Thorp's technique is unique. He runs his funds without the usual panoply of security analysts' reports, market letters and economic forecasts. He makes no attempt to forecast the course of individual stocks or the market, believing it fruitless. In his world, there is little room for such traditional money-manager traits as hunch playing and intuition.

Instead, he relies on proprietary mathematical formulas programmed into computers to help spot anomalies between options and other convertibles and their common stock. The computer models tell him the price a convertible theoretically should be selling for, after such facts as the price of the underlying stock, its volatility and the conversion terms are fed into the computer. When a convertible's actual price is higher or lower than the theoretical one, his funds act accordingly. In some cases, the funds' trading is dictated completely by computer printouts, which not only suggest the proper position but also estimate its probable annual return.

#### "Remote Control"

"The more we can run the money by remote control the better," Mr. Thorp declares. "That way we can concentrate on important things like improving our theoretical formulas and getting the best executions possible on our trades."

Mr. Thorp's funds are an example of an incipient but growing switch in money management to a quantitative, mechanistic approach, involving heavy use of the computer. The trend, in part, is the product of the bear markets of recent years, which dis-

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credited many traditional money-management practices.

Among other things, the new approach has spawned the so-called "Beta Revolution"—an attempt to quantify the volatility of individual stocks and entire stock portfolios so that money managers can know precisely the risks of various investment decisions. But nowhere has the new style been more apparent than in the hedging and arbitrage field, which because of its complexity and pure mathematical relationships lends itself to such an approach.

Professors are developing valuation formulas for all types of convertibles at such places as the University of Chicago's Graduate School of Business and Massachusetts Institute of Technology's Sloan School of Management.

Moreover, several professors have left their ivory towers to join Mr. Thorp in the hedging game. One is Dennis Gish, a former assistant professor of computer science at UCLA, who now is a principal partner in FAMCO Inc., a New York brokerage concern that manages private hedging accounts.

A number of institutional brokerage houses and money-management concerns recently have adopted the academic computer models in managing arbitrage portfolios, although few rely on them as much as Mr. Thorp. The most popular model these days is the Black-Scholes Model for valuing options, developed by Fischer Black and Myron Scholes, two University of Chicago business-school professors. Among its users are Goldman Sachs & Co. and Donaldson, Lufkin & Jenrette Securities Corp. "While the model is just one of many tools we use in deciding positions, we feel it has given us a real mathematical edge," says Mike Gladstein, a Donaldson Lufkin vice president involved in its option operations.

Not surprisingly, the new computerized-trading approach leaves many traditionalist money managers cold. "The whole computer-model bit is ridiculous because the real investment world is too complicated to be reduced to a model," one mutual-fund manager contends. "You just can't replace the money manager using security analysis and market feel with a machine."

A recent trade illustrates how the Thorp technique works. On June 11, the computer alerted the funds to an interesting situation that had developed with several Upjohn Co. securities. At the time, the stock was selling on the New York Stock Exchange at \$88 a share, and the Upjohn call option expiring at the end of July 1974 on the Chicago Board Options Exchange was selling for \$5 a share. A call is simply a right to purchase shares of a stock at a specific exercise price during a given time period; though each call covers 100 shares, its price is customarily quoted on a per-share basis. The call the computer singled out had an exercise price of \$85 a share.

## **A \$14,377 Profit**

According to the computer, the option was underpriced and should have been selling at about \$7.50 a share. So the fund bought 50 July Upjohn calls (for a total of 5,000 shares) for \$5 a share, or a total cost of \$25,452 after commissions. Simultaneously, it sold short 3,200 shares of the underlying stock for \$88 a share, or \$279,810 after commissions and taxes. (A short sale is, in effect, the sale of stock you don't own but anticipate will drop in value; at a given future date, you must "cover" your short sale by buying the stock at the then-current price. If the price has dropped, you have made a profit; if not, you lose.)

Two weeks later, the stock had dropped to \$75.50 a share and the option had plummeted to 62.5 cents a share. The fund then covered its short position in the stock at \$242,856 after commissions, making a profit of \$36,954 on the stock trade. At the same time, it sold the calls for \$2,875 after commissions, taking a loss of \$22,577 on the call position. Thus, in less than three weeks, it realized an overall profit of \$14,377 on a total investment of some \$170,000 (the fund only put up 50% margin on its stock short sale). The position was constructed to yield a profit if Upjohn's stock moved below \$80 a share or above \$94 a share, neither of which was an unreasonable expectation given the stock's historic volatility.

Mr. Thorp explains: "In hedging, you don't make a big killing with individual positions, but you rarely lose big either. If you hedge properly, you can win on nine out of 10 trades. I call it getting rich slow."

Mr. Thorp's preoccupation with system play goes back to the late 1950s, when he was an obscure mathematics instructor at MIT. The son of a Los Angeles security guard, he had yearned for a way to make money from his scholarly pursuits. By chance, he read a paper in a statistics journal on an elementary system to reduce the house's advantage to blackjack. Intrigued, Mr. Thorp spent two years in laborious analysis of blackjack, availing himself of MIT's IBM-704 computer along the way.

## **Beating the House**

The upshot of his efforts was the discovery that if a player could keep track of the cards as they were played and bet heavily only when he enjoyed a statistical edge, then he could beat the house. He tested his theories during a number of forays in Las Vegas and Reno, running up \$25,000 in winnings. He later wrote a best-seller on his experience called "Beat the Dealer."

By the middle 1960s, Mr. Thorp, looking for new worlds to conquer, turned his attention from gambling to the stock market. His first investment experience was anything but auspicious. He put his gambling profits into a life-insurance stock that promptly plummeted in price. "I singlehandedly ended a 20-year bull market in life insurance stocks and in a few other industries 'too,' he recalls ruefully.

It was about this time that he hit upon his present hedging system. His interest was piqued by a brochure on warrants—securities issued by companies giving the right to buy their common stock at a set price during a given time period. Upon analysis, he discovered that the prices of most warrants in the feverish bull markets of the mid-1960s were inflated in relation to their common stocks. So he began systematically selling warrants short while buying their underlying stocks to protect against sudden surges in the market.

By 1967, his \$25,000 had become \$100,000. With a fellow professor at the Irvine campus, he co-authored a book on warrant hedging entitled "Beat the Market." He also soon found himself managing \$1.5 million thrust upon him by eager friends and relatives.

He got into the money-management game in earnest in late 1969 when he and Jay Reagan, a 28-year-old institutional salesman from the Philadelphia brokerage house of Butcher & Sherrerd, teamed up to form a private investment partnership. Today their company, Oakley Sutton Management Co., runs two hedge funds and a brokerage affiliate.

These days, Mr. Thorp divides his time between an Oakley Sutton office in Newport Beach and his university office. The funds' office is only minutes by car from his home, where he lives with his wife, Vivian, and three children.

## **Almost Automated Trading**

At the heart of Oakley Sutton's operations are its half-dozen models covering each type of convertible. They are, in part, the product of abstruse theorizing by Mr. Thorp on mathematical laws governing the behavior of convertibles in relation to their underlying stocks. Mr. Thorp also uses the computer to check the historic behavior of stocks and their related convertibles to determine the relative weight of various factors such as the conversion terms, prevailing interest rates and stock volatility in determining the price of the convertibles.

So confident is Mr. Thorp of several of his models that the funds' trading in some convertibles is all but automated. For example, Oakley Sutton's trading on the Chicago Board Options Exchange is based almost entirely on computer printouts alerting Mr. Reagan and Oakley Sutton's three traders on the exchange floor to favorable situations.

However, such convertibles as long-term convertible bonds defy complete reliance on models because of the variety of factors affecting them. In addition, Mr. Thorp and three assistants laboriously maintain charts on more than 1,000 convertible-bond and preferred-stock situations to spot anomalies. "Here we've discovered some shortcuts to the computer that I can't describe without helping our competitors too much," he says.

These days, the bulk of Oakley Sutton's 100 or so hedges are in options with the rest in other convertibles and commodity arbitrages. Soaring interest rates have depressed convertible-bond prices, reducing the number of attractive hedge opportunities.

Hedging in warrants has become more difficult because of a sag in their prices brought on by depressed stock prices. Also a number of companies have been altering the terms on their warrants lately, which tends to throw the calculations of hedgers askew.

## **Rube Goldberg Complexity**

Many of the positions have the complexity of Rube Goldberg creations. One recent trade in Ford Motor Co. involved the purchase of its stock, two convertible bonds, one convertible Eurobond and a call option along with the sale of five different call options.

Oakley Sutton does some investment research, though it is a far cry from traditional security analysis. Mr. Thorp and his assistants mainly comb financial newspapers, prospectuses and other legal documents covering convertibles, looking for information like changes in conversion terms, tender offers, and impending bond-rating changes. "In short, we're interested in any factor that might affect the goodness of a given hedge," he says. "Most security analysts call the president of companies to get a line on future earnings. Instead we call the company lawyer to see if the company is going to violate its conversion obligations."

With all its computer models and hedged risks, the Oakley Sutton funds sometimes take nasty losses. In one such instance, the funds lost \$107,000 on a \$250,000 bond hedge in U.S. Financial Corp. when the company filed a Chapter 11 bankruptcy. "In most of our positions, our major risk is a company going belly up, but, of course, this doesn't happen that often," he says.

At present, Mr. Thorp is hard at work on computer models covering put options and commodity spreads. He also talks of developing an overarching theory on all convertibles. Sitting in his office on a recent afternoon, garbed in a mod shirt, wash pants and sandals, he mused aloud, "In a way, I wish the anomalies in markets would disappear suddenly so that I could relax for a while."