CUBICASSET MANAGEMENT, LLC

2007 4th Quarter Stock Market Commentary

IN-GENE-IOUS INVESTING: SPOCK VS CHARLES DARWIN

"Quants: The name given to mathematicians and physicists who surrender science and scruples in exchange for Porsches."
- Edward Chancellor

Harry Markowitz is a towering figure in finance. In the early 1950s, while a graduate student at the University of Chicago, Markowitz chose as his thesis topic the application of mathematics to the study of the stock market. He quickly realized that research up to that time had focused only on stock returns, without regard to the risk taken to achieve them. He developed a methodology now known as mean-variance analysis, a theory and technique for combining risky assets in a way that minimizes the risk for a given level of return, or maximizes the return for a given level of risk. The collection of all of these optimized portfolios is called the "efficient frontier", and, according to Markowitz, every rational investor desires to invest along that frontier. This work led to the eventual development of the capital asset pricing model and modern portfolio theory, for which Markowitz was awarded the Nobel Prize in 1990.

In a recently published book, Your Money & Your Brain, by financial columnist Jason Zweig, there is a wonderful story about Markowitz while he was working at the RAND Corporation. The human resources department asked him to determine the asset allocation for his retirement account. As the developer of the technique to do this, Markowitz knew exactly what to do. He wrote, "I should have computed the historical co-variances of the asset classes and drawn an efficient frontier." That's Markowitz, in his best imitation of the logical Vulcan Spock (from Star Trek), speaking.

Instead, he continued, "I visualized my grief if the stock market went up and I wasn't in it – or if it went way down and I was completely in it. So I split my contributions 50/50 between stocks and bonds." Even Markowitz, who postulates that the rest of us are all rational, economic men (like Spock), turns out to be moved more by fear and greed, emotions that have been hardwired through millions of years of evolutionary forces.

Until recently, the conventional wisdom about the capital markets was that they are "efficient", meaning that the prices of stocks and bonds rationally reflect all publicly available information. To an efficient market theorist, stock research and active money management are a waste of time, since throwing darts at the stock tables in the newspaper is likely to do as well as a professional stock picker. Efficient market theorists, like holocaust deniers, conveniently dismiss evidence that seems to contradict this elegant construct. The track records of noted stock pickers, such as Warren Buffett and Peter Lynch, who

outperformed the market over very long periods by a very wide margin, are considered as simply the normal outcome of randomness, analogous to a million monkeys tapping on typewriters and producing the Bible. The 1987 Crash, in which prices dropped 23% in a single day without any change in the economy (Was it efficiently priced the day before the Crash, or the day after?) is ignored completely.

More recently, the notion of efficient markets has been challenged by practitioners of behavioral finance, who try to explain markets by blending psychology and finance. They observe how investors actually behave, whether rational or not, studying cognitive biases which predispose us to certain types of investment decisions that are frequently contrary to our financial interests. The pioneering research in this field was done by Daniel Kahneman (currently at Princeton University), working often in collaboration with Amos Tversky at Stanford University. Tversky died in 1996 without ever seeing his work accepted into the mainstream. In 2002 Kahneman was awarded the Nobel Prize in economics, an unusually impressive achievement considering that his PhD from the University of California at Berkeley was in psychology, and he has never taken a single economics course. Today, there are literally thousands of researchers in the field, with the usual panoply of scholarly journals, conferences and research institutes.

Despite the validation of behavioral finance that the Nobel Prize conveyed, the vast majority of business school faculty still rejects its basic principles. Fully 83% of finance professors do not believe that the heuristic biases studied in behavioral finance can be exploited, and maintain that no investment strategy can beat the performance of the market indices (i.e. the market is efficient).

This "head-in-the-sand" attitude is going to be harder to maintain, though, in the face of the findings produced by a relatively new technology known as functional magnetic resonance imaging, or fMRI. It has been known since the late 19th century that changes in blood flow are associated with neural activity in the brain. When one region of the brain is active, it consumes more oxygen, which in turn is carried by hemoglobin in the red blood cells. This increase in blood flow occurs after a delay of two or three seconds. The Broca's area in the left hemisphere becomes active during language processing, for example, while the parietal and prefrontal cortices are involved in arithmetical computations.

Colin Camerer, an economist at Caltech in Pasadena, California, is one of the founders of the emerging field of neuroscience. He uses fMRI to examine the brains of volunteers as they play economic games in a laboratory. In one set of experiments recently reported on in an article called "Mind Games" in the New Yorker, subjects placed bets on whether the next card to be drawn from a special deck would be red or black. In the first version of this game, players were informed the proportion of red and black cards, so that they could compute the probability on each draw. This is a relatively low risk game, since the correct strategy is obviously to bet on the color with the greater representation. In the second version, players were told only the total number of cards in the deck, but not the number of each color. This is a riskier situation, since the players have less information to go on. Camerer found considerably greater activity in the amygdala and in the orbitofrontal cortex (which itself is thought to modulate activity in the amygdala). The amygdala is a structure roughly the size and shape of a pair of almonds located just below the medial temporal lobe. Part of the limbic system, it has long been associated with emotion, particularly fear and anger. The experiments suggest (and other experiments confirm) that when people are faced with ambiguity (like when they have to decide whether to buy a particular stock), their emotions can overpower logic and force them to make poor decisions.

A good illustration of this can be found in the following simple betting game, conducted by Antoine Bechara, associate professor of neurology at the University of Iowa. An individual is given $20 and then permitted to bet $1 on each of twenty coin tosses. If he/she loses, the loss is $1. If the player guesses the toss correctly, he/she wins $2.50. The player can elect to sit out any of the twenty rounds, in which case he/she gets to keep the $1.

Anyone schooled in probability can see immediately that this game is very favorable to the player. The expected return to the bettor on any single toss is $0.75, more than twelve times greater than the house edge in roulette, for example. A smart player should bet every time they are given a chance. Surprisingly, though, participants elected to bet only 58% of the time, becoming more cautious as the game progressed, especially if they had lost in the early rounds. Fear of losing (so called loss aversion) caused people to make bad economic decisions. This game has been repeated with bets of $10 (and corresponding payoff of $25 for a winning toss), $100 or $1,000. The larger the bet, the less likely the player is to bet, even though the odds are unchanged.

Mathematically, a player in an even game should take every bet anytime the payoff exceeds the loss, even if a win pays only $1.01. But they don't. Research by Daniel Kahneman in 2002 showed the psychological impact of possibly losing $1 is roughly equal to that of winning $2.

The study described above was repeated with test subjects who had experienced a brain lesion in the amygdala that impaired their ability to experience fear. These participants accepted the bet 84% of the time. This is still below the 100% level of bets that the rational Spock (or Warren Buffett) would accept. It seems that a certain degree of emotional detachment is necessary to be a good investor.

In a man-bites-dog way, the emotional detachment required for good investing is one of the few things that improve with age. Neurologists have shown that the amygdala becomes less active as we age. fMRI scans show that investors in their sixties get considerably less upset than those in their twenties when faced with the prospect of a loss. Older investors are considerably better at dealing with the stress of a bear market than younger ones. Unfortunately, this loss of fear comes with a cost. The decline in fear makes senior citizens less skeptical, and therefore more vulnerable to get-rich quick sales pitches.

The amygdala is far from the only brain structure that neuroimaging shows can lead us astray in making investment decisions. When given news that a company has reported earnings above consensus expectations for two consecutive quarters, the anterior cingulate lights up. This is the portion of the brain that finds patterns in a set of data. This is a skill that has been finely honed over millions of years of evolution. After all, it is highly advantageous to observe that fish tend to feed at dawn and dusk, for example, or that the sun always rises in the East. The problem is that two data points are insufficient to form a pattern. A baseball team that wins two games in a row is not likely to win the remainder of the games on its schedule, and a coin that produces heads on two consecutive flips won't continue to do so indefinitely. But too frequently investors base decisions upon a trend that simply does not exist.

Yet another set of brain structures that helps lead to poor decision making is known as the reward center. This consists primarily of the nucleus accumbens (located in the limbic system, not far from the troublemaking amygdale) and the ventral tegmental area, which are connected by the median forebrain bundle. The names are not particularly important to remember, but the basic function of this system is. It evolved primarily to promote activities essential for survival, like eating or sexual intercourse. Such activities stimulate the reward pathway, whose neurons then release the chemical dopamine, which creates a feeling of well-being. Certain drugs of abuse, like cocaine, hijack the reward center causing it to be flooded with dopamine. Laboratory rats, if given a chance to electrically stimulate the nucleus accumbens will do so to the exclusion of other activities. They will starve to death before they give up their fix.

It turns out that the anticipation of a financial reward (such as buying a stock that goes up) activates these same pathways. Interestingly, actually receiving the reward usually depresses dopamine levels slightly from the period of anticipation. Receiving a reward is not nearly as pleasurable as anticipating it. This seems to be why stocks like DreamWorks or Pixar frequently rise before the release of a hyped new

movie, only to fall back after the movie comes out. Apple often rises in the month before MacWorld, and falls after. It is one possible explanation of the long term outperformance of value stocks over growth stocks. Because the latter already have expectations of growth priced in, they create a feeling of depression when the growth occurs, leading to selling. By contrast, value stocks tend to be priced for, at best, neutral expectations.

Our discussion has touched upon but a few of the many ways in which our biology determines our investment destiny. There are far too many others to discuss in a brief essay. We could have focused, for example, on how the failure to match expectations depresses serotonin levels, resulting in irritability and impulsivity. This pushes many individuals to over-trade (with no overarching philosophy) in the frantic search for a profit. But regardless of which neurological studies we examine, there is one dominant theme. Most of us, far from being rational economic beings who allocate capital to the highest expected return opportunity, are instead a bundle of emotions which interfere with logical thought. One minute we are giddy, expecting a quick payoff from the stock of a company with a glamorous new product. The next we are anxious and depressed, checking the value of the investment every few minutes.

What is the solution? Individuals need to formulate an investment philosophy. The philosophy will, of course, vary from individual to individual, depending on personality and objectives. Once formulated, though, the key is to stick to the plan. Neurotic people will have trouble making decisions, and this vacillation may prevent implementation. Extroverts will be tempted to jump at opportunities that they hear about on CNBC, without any background research, and without regard for whether it is consistent with their philosophy. The trick is to avoid these emotional urges and stick to the plan. Or simply let someone else do it for you.