

PART I
THE BEHAVIORAL
ATTACK

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Who Could Design a Brain . . .

Alfred Marshall, the great Victorian economist, opens his *Principles of Economics* with these words:

Economics . . . examines that part of individual and social action which is most closely connected with the attainment and with the use of the material requisites of wellbeing. Thus it is on the one side a study of wealth; and, on the other, and more important side, a part of the study of man.

Marshall's *Principles* were to set the tone of economics for the next half century. In this work, despite his noble words in the quotation above, he made the study of man secondary to the study of wealth. Under all conditions, man in classical economics is an automaton capable of objective reasoning. Furthermore, disagreement about the future—a fundamental feature of the study of man—has no place in this particular study of wealth. Marshall's approach was finally dislodged, with great difficulty and after many years of dispute, by the publication in 1936 of his student John Maynard Keynes's masterwork, *The General Theory of Employment, Interest, and Money*.

The bundle of ideas, models, concepts, and systems embodied in the theoretical structure of modern finance—what I describe as Capital

Ideas—appeared between 1952 and 1973. They owe little to Keynes and almost everything to Marshall. The entire underlying structure of Capital Ideas rests on one overriding assumption: Investors have no difficulty in making optimal choices in the bewildering jumble of facts, rumors, discontinuities, vagueness, and black uncertainty that make up the real world around us.

Over time, this tension between an ideal concept of human rationality and the coarse reality of our daily lives has become an increasingly contentious issue. How much do we know about how people in the real world arrive at decisions and make choices? How great are the differences between the theoretical assumptions and the real world? And do those differences matter?

Although these questions have always been central to understanding the way investors behave and how their responses affect the performance of financial markets, no one made any systematic effort to provide the answers until the mid-1960s. The most significant and influential effort to approach these problems, a field of study that has come to be known as Behavioral Finance, began to take shape quite by accident when two junior psychology professors at Hebrew University in Jerusalem, Daniel Kahneman and Amos Tversky, happened to compare notes one day about their work and their life experiences. The hugely productive result of their friendship and subsequent collaboration has created a competing vision to the rational model of how people make choices and reach decisions under conditions of uncertainty.* The essence of this work is the study of man—of human behavior.

As Kahneman and Tversky wrote in 1992: “Theories of choice are at best approximate and incomplete. . . . Choice is a constructive and contingent process. When faced with a complex problem, people . . . use computational shortcuts and editing operations.”¹ The result is a decision-making process differing in many aspects from the assumptions of Capital Ideas.

It would be a mistake to accuse Kahneman and Tversky of tarring all humanity with the black brush of irrationality. That was never the case, as Kahneman’s autobiography makes clear: “The interpretation of our work as a broad attack on human rationality rather than a critique

*Tversky died at the age of 59 in 1996. Kahneman, now at Princeton University, was awarded the Nobel Prize in Economic Sciences in 2002.

of the rational-agent model attracted much opposition [to our efforts], some quite harsh and dismissive.”² As Kahneman put the point to me, “The failure in the rational model is . . . in the human brain it requires. Who could design a brain that could perform in the way this model mandates? Every single one of us would have to know and *understand* everything, completely, and at once.”* He expresses this position even more precisely in writing:

I am now quick to reject any description of our work as demonstrating human irrationality. When the occasion arises, I carefully explain that research on heuristics and biases only refutes an unrealistic conception of rationality, which identifies it as comprehensive coherence. . . . In my current view, the study of judgment biases requires attention to the interplay between intuitive and reflective thinking, which sometimes allows biased judgments and sometimes overrides or corrects them.³



Kahneman’s and Tversky’s published papers, both individually and jointly, constitute an imposing compendium of evidence, ideas, and axioms of human behavior in the process of decision making. One of the most interesting features of Kahneman’s and Tversky’s work is the innovative nature of their discoveries. The patterns of human nature they discuss must have existed since the beginning of time, but no one before them had caught their vision. They unleashed a far larger flood of research from other academics and, over time, from the practitioner side as well.

In highly compressed fashion, the rest of this chapter conducts a survey of Behavioral Finance based on a small but characteristic sample of these investigations. The implications of this survey for investment are fascinating, but along the way the material also provides a mirror in which we see ourselves probably more often than we would like.

* Unless otherwise specified, all quotations come from personal interviews or personal correspondence.

The real issue is this: How much damage has this attack inflicted on the standard theories and models of finance? Do the critique of the rational-agent model and the demonstrations of its empirical failures render my book, *Capital Ideas*, useless and at best obsolete? Or, in a more practical mode, do the teachings of Behavioral Finance lead us to alpha—to an excess return on our investments after adjustment for risk?

Final judgment must await the presentation of the evidence. But final judgment will be rendered.

Before moving on, a separate point is worth making. The focus of the discussion so far has been on how the findings of Behavioral Finance relate to each of us as an investor. But a deeper issue is also involved, set forth by John Campbell of the Economics Department at Harvard in his presidential address to the American Finance Association in January 2006:

Even if asset prices are set efficiently, investment mistakes can have large welfare costs for households. . . . They may greatly reduce the welfare gains that can be realized from the current period of financial innovation. . . . If household finance can achieve good understanding of the sources of investment mistakes, it may be possible for the field to contribute ideas to limit the costs of these mistakes.*



A story that Kahneman recounted in the course of his address accepting the Nobel Prize provides a typical example of the “computational shortcuts and editing operations” we use in our attempts to make choices in complex problems. Kahneman had conducted an experiment with two different audiences. Although he offered both audiences an identical set of choices, he presented these choices in different settings that led to strikingly different results.

He asked each audience to imagine a community preparing for the outbreak of a dreaded disease. The experts have predicted the disease will kill 600 people if nothing is done, but they offer two different programs to deal with the contingencies.

* Campbell (2006).

Under Program A, 200 people will be saved. Under Program B, there is a one-third possibility that all 600 people will be saved and a two-thirds' probability that everybody will die. Kahneman found that the audience presented with these choices overwhelmingly favored Program A, on the basis that the gamble in Program B was too risky. The certainty that 200 people would be saved was preferable to a two-thirds' chance that everybody will die.

Then Kahneman presented the identical choices to the other audience, but in a revised setting. Under Plan C, 400 people will die. Under Plan D, there is a one-third chance that nobody will die and a two-thirds' probability that 600 people will die. Now the audience's choice was for Plan D. The gamble, in its Plan D garb, now seems preferable to Plan C, in which it is certain 400 people will die.

How can we account for these opposing sets of responses to what are identical choices and probabilities? As Kahneman explains it, nobody has ever figured out a perfect technique for dealing with uncertainty. Consequently, in making choices and decisions, we tend to overweight certain outcomes relative to uncertain outcomes, even when the uncertain outcomes have a high probability. In the case of the first audience, the certainty of saving 200 out of 600 people is "disproportionately attractive." In the case of the second audience, accepting the certain death of 400 out of 600 people is "disproportionately aversive."

Kahneman and Tversky have defined these kinds of inconsistencies in decision making as "failure of invariance." The failure of invariance comes in many colors, with endless variations of the theme.* Invariance means that if A is preferred to B and B is preferred to C, rational people should prefer A to C. In the case above, if the rational decision in the first set is 200 lives saved for certain, saving 200 lives for certain should be the rational decision in the second set as well.

Kahneman and Tversky use the expression, "framing," to describe these kinds of failures of invariance, which are widely prevalent. In the example of the outbreak of the dreaded disease, the audience in the first case framed their responses around how many people would live, while the second audience framed their responses around how many people might die. Kahneman's Nobel address defines framing as "the passive

* See, in particular, Thaler (1991), which describes many examples of the failure of invariance and framing.

acceptance of the formulation given.” And then he adds, “Invariance cannot be achieved by a finite mind.”⁴



Richard Thaler of the University of Chicago, one of Kahneman's and Tversky's earliest and most articulate disciples, describes an amusing example of the failure of invariance involving money. Thaler proposed to students in one of his classes that they had just won \$30. Now they could choose between two outcomes: a coin flip where the individual would win \$9 on heads or lose \$9 on tails, or no flip of the coin at all. The coin flip was the choice of 70 percent of the students. When his next class came along, Thaler asked the students to assume that they had a starting wealth of zero. Now they could choose between these two options. The first was a coin flip where the individual wins \$39 on heads and \$21 on tails. The second was \$30 for certain. Only 43 percent of the students chose the coin flip; the majority preferred the \$30 for certain.

When you study the options offered to both classes, you will find that the payoffs are identical. Whether the starting wealth is \$30 or zero, the students in both cases are going to end up with either \$39 or \$21 versus ending up with \$30 for sure. Yet the majorities of the two classes made entirely different choices, resulting in a failure of invariance.

Thaler ascribes this inconsistency to what he calls “the house money effect.” If you have money in your pocket, you will choose the gamble. If you have no money in your pocket, you would rather have the \$30 for certain than take the risk of ending up with \$21.⁵

In the real world, the house money effect matters. Investors who are already wealthy are willing to take significant risks because they can absorb the losses, while investors with limited means will invest conservatively because of fear they cannot afford to lose the little they have. This is precisely the opposite of how people with different wealth levels should arrive at decisions. The wealthy investor is already wealthy and does not need to take the gamble. If investors with only a small amount of savings lose it all, this would probably make little difference, but a killing on the small accumulation could change their lives.

Another investment-oriented version of the distortions caused by framing resulted in an experiment conducted in 2001 by Thaler and his

frequent coauthor Shlomo Benartzi of UCLA.⁶ Participants were divided into three separate groups with no contact among the groups. Each group was given a choice of two fund offerings for their retirement plans. One group was offered a fund holding just stocks and a fund holding just bonds. The second group was offered a fund holding just stocks and a balanced fund that includes stocks and bonds. The third group was offered a bond fund and a balanced fund.

Even though these choices were for retirement funds that should have had roughly the same asset allocation decisions, the three groups ended up with wide differences in portfolio structures. The differences arose because the 50–50 choice is always popular: It seems like common sense; it looks like diversification; and it avoids the complex decision about how assets should be allocated in a retirement fund. The consequences were dramatic. The first group, choosing between a stock fund and a bond fund, ended up with an average allocation of 54 percent to equities. The second group, offered a stock fund and a balanced fund, also leaned in the 50–50 direction between the two funds, but ended up with an average allocation of 73 percent to equities and only 27 percent to bonds, because half the balanced fund was already invested in equities. The third group, offered a bond fund and a balanced fund, ended up with an average of 65 percent in bonds and only 35 percent in equities.

The experiment demonstrates that framing determined the decision making among the three groups. The proper approach should have been to consider the different expected rates of return and risks of each asset class and to see through to the underlying structure of the balanced fund in making the final choice. Fifty percent to each asset class might not have been optimal, but it would have been a sensible choice for someone with no experience or no understanding of the different risk–return trade-offs between stocks and bonds. In fact, however, the design of the offering dominated. Most of the participants were unwilling to make the intellectual effort to see through the 50–50 allocation of the balanced fund and recognize that the true asset allocation was a long way from 50–50.

This experiment was not just an artificial effort to find out how people make choices where framing is likely to dominate. The 50–50 choice tends to dominate at TIAA-CREF, the huge retirement fund for university faculties. Here, at least, there is professional advice available

to help participants avoid the simplifications of framing and, instead, to understand the structure that would best suit their needs. But I must also report that one of the famous developers of the theory of finance, whose current activities receive an entire chapter in this book, has confessed he has also made the 50–50 choice at TIAA-CREF.



The proponents of Behavioral Finance have drawn heavily on the writings and teachings of Kahneman and Tversky. They have made human quirks like the failure of invariance, framing, and the illusion of validity the core of their confrontation with the assumptions of the rational model that motivates and supports the structure of Capital Ideas. The issue is *why*—why does reality differ so much from the idealized world that underlies the efficient market and the Capital Asset Pricing Model? And, after we settle that matter, a more important question faces us, already suggested earlier: Can Behavioral Finance enable us to outperform the market?

Although human beings have extraordinary reasoning power compared with animals, something other than cool analysis and calculation seems to take over when we are faced with difficult choices—even though, on many occasions, we honestly believe we have made a rational decision. Nobody ever knows what the future holds, which means decision making is always a daunting challenge. The only certainty in the whole process is that more things can happen than will happen.

For example, the mean temperature on the fourth of July could be over 100 degrees or as cool as 50 degrees. But even under the unrealistic assumption that we could precisely calculate or estimate the probability of each degree of temperature in that range, and that the range is in fact the correct range, we are still in the dark about how hot or cool the day is actually going to be. And most decisions have a much wider range of possible outcomes, so wide we cannot even know all the outcomes we might have to deal with. In other words, most good forecasts should not be point forecasts or a mean of possible outcomes. Rather, it is the *range* that matters for decision making and risk measurement.

This struggle is especially intense when it comes to decisions involving our wealth. Finance and investment are bets on future outcomes—investing means we put away money today because we expect

to earn a future return on it. Even in the unlikely event that everything else works out as planned, the future purchasing power of money is uncertain. As a result, these uncertain investment outcomes could range from making us rich and famous to putting us on a fast train to the poorhouse. Investing is a deadly serious process, not an enthralling game or a substitute for gambling in a casino as some people view it.

As Kahneman and Tversky put it, using psychology-speak, investors have “cognitive difficulties” in their efforts to arrive at profitable decisions.* Yet people who are not so smart frequently become rich. If they are lucky enough to avoid being wiped out immediately, they can survive for a long time and create all kinds of mispricings that scare away more sober investors. Keynes observes that the market could stay at crazy levels longer than most people could even imagine.†



Yogi Berra is reported to have said that forecasting is very difficult, especially when it comes to the future. Most of life is about making decisions whose outcome is hidden from us. Faced with what looks like an impossibly complex process, why would we not tend to look for shortcuts—or heuristics—to reach our decision more easily? Many times, and especially in investing, uncertainty comes lumped together with complexity. But the shortcuts we use to extricate ourselves from these dilemmas lead to inadequate processing of information, or avoiding the use of information entirely and relying on our gut to guide us.

An interesting slant on how we confront complexity and uncertainty comes from Barr Rosenberg of AXA Rosenberg, one of the most persuasive early proponents of Capital Ideas and a distinguished scholar on his own (see Chapter 13 of *Capital Ideas*): “I became interested in capital markets rather than other economic processes because the stock market is approximately a taste-free world; in other words, the ideal investor simply would look for superior returns. . . . Behavioral finance is the healthy antidote to that view by saying, ‘No, actually, it’s not a

*For a fascinating discussion of cognitive functions framed in terms of the structure and operation of the human brain, and the distinctions between so-called rational and non-rational decision making, see Cohen (2005).

†See De Long et al. (1991).

taste-free world.’” And then Rosenberg adds, “As you know, the discounted future dividend stream of stocks [has] such very long durations that instinct has to play a major role in valuation.”⁷

Many of the problems we encounter in this process of oversimplification and instinctive responses stem from the limits of our imagination, although sometimes we impose limits we do not have to impose. One of the most dangerous of these habits is to believe low-probability events will not happen. A probability of one chance in a hundred is still more than zero. Crossing the street can be fatal even if you are a fast runner, and a massive earthquake could occur in San Francisco at any moment. The chances are low that you will be hit if you run fast or that San Francisco will crumble tomorrow, but the probabilities tell you nothing about when such an event might occur.*

This imbalance in our imagination is just one example of how we slice and dice our view of reality to simplify our course of action. We focus on the short term because the long term is too vague—and anyway it is not the domain in which we live. Yet understanding the distinctions between the short run and the long run is essential. The investor with a short-term horizon has to take what comes, for better or for worse. The investor with a long-term horizon—which is another way of saying the investor has a higher tolerance for volatility—has the opportunity to hedge against unfavorable outcomes. For example, the long-term investor can buy the U.S. Treasury’s inflation-protected bonds (TIPs), which make little difference to his fortunes over the next year but could make a tremendous difference in what happens to his wealth if inflation unexpectedly persists over the next twenty years.

That is not all. We extrapolate recent developments into the longer-run future without questioning their significance for a constantly changing world. We cling to our preconceptions even when the evidence in front of us shows they are outdated. We are content being inconsistent because consistency may be too demanding. The possibility of regretting a decision dilutes our ability to make a rational decision in the first place. We often make the mistake of heeding what others say when they agree with us, even when they may know less than we do. We display a tendency to take greater risks when faced with losses than

*This point and related versions of it are elaborated skillfully in Mauboussin (2006). Michael Mauboussin is Director of Research at Legg Mason & Co.

when faced with gains. We make judgments on the basis of small samples of information that are far from representative of the broad generalizations on which we want to base our decisions, largely because we often have nothing else available.

Yet all through the process, we display overconfidence in our own beliefs even though our better judgment should recognize the high risks in thinking we know more than the consensus of the people in the marketplace. Many of those individuals have more information and understand the situation better than we do. Kahneman describes it this way: "The central characteristic of agents is not that they reason poorly but that they often act intuitively. And the behavior of these agents is not guided by what they are able to compute, but by what they happen to see at a particular moment."⁸

The results from these kinds of heuristics can be costly. For example, Terrance Odean of the University of California, Berkeley, and Brad Barber of the University of California, Davis, studied the trading activity in a large number of investor accounts at a nationwide discount brokerage house. They found, with extraordinary frequency, that the stocks these investors sold went on to earn higher returns than the stocks these investors purchased to replace those holdings.⁹

For better or for worse, individual investors have plenty of company among sophisticated chief investment officers of pension plans, foundations, and university endowment funds. Amit Goyal and Sumil Warhal of Emory University studied some 3,700 corporate pension funds from 1994 through 2003 to determine their skill in selecting external investment managers. The 3,700 funds transferred a total of over \$700 billion to external investment managers during the period covered by the study. These pension funds hired new managers showing large positive excess returns up to three years prior to hiring and fired existing managers after they had underperformed.

The result was essentially the same as for Odean and Barber's individual investors: "If plan sponsors had stayed with fired investment managers, their excess returns would be larger than those actually delivered by newly hired managers." In addition, the funds would have saved all the brokerage costs involved in management changes.¹⁰

In short, we are human beings. Financial theory has to take account of that incontestable fact. But how much does it matter to the Efficient Market Hypothesis and related works that the quirks of Behavioral

Finance are a good description of reality? How certain can we be that behavioral issues mean the market is inefficient? Or, to put it more bluntly, how much money can we make as investors by studying the many interesting stories Behavioral Finance has to tell us? These questions motivate the rest of this chapter.



Kahneman's and Tversky's work naturally attracted academics working in finance who were seeking new insights into how the capital markets work and how investors make decisions.* Among the earliest of their acolytes was a young graduate student named Richard Thaler, whose work on the house money effect we have already noted. Thaler is now among the leaders in the field of Behavioral Finance. Indeed, after teaching at Cornell and MIT, Thaler was appointed Robert P. Gwinn Professor of Behavioral Science and Economics at the Graduate School of Business of the University of Chicago in 1995, where Eugene Fama and his colleagues have had to put up with—and ultimately learn from—this energetic and iconoclastic man.

Thaler had been browsing in the field of psychology before he ever heard of Kahneman and Tversky. In the early 1970s, while working on his doctoral dissertation at the University of Rochester—where at the time rational theory was considered beyond dispute—he began to speculate on how to calculate the value of a human life. It occurred to him that the correct measure would be how much people are willing to pay to save a human life. And so he began asking friends and students what value they would put on their own lives.

He sought the answer to these questions. First, what would you pay to *eliminate* a one-in-a-thousand chance of immediate death? Second, turning the first question around, he asked how much you would have to be paid to *accept* a one-in-a-thousand chance of immediate death. Not knowing exactly what to expect, he was dumbfounded at the differences in the answers to the two questions.

*Chapter 17 of my book, *Against the Gods: The Remarkable Story of Risk*, entitled “The Theory Police,” discusses the work of the people in Behavioral Finance at length. I have drawn on that discussion in what follows.

In general, most of the answers were along the lines of: “I wouldn’t pay more than \$200 to eliminate a small chance of immediate death, but I wouldn’t accept such an extra risk for \$50,000.” Thaler found these huge differences between buying and selling prices “*very* interesting.”

The wheels were beginning to turn. He started to compile a list of what he called “anomalous behaviors”—behaviors that went against the predictions of the standard models in finance. He discovered a variety of such violations, which he describes in a paper in 1976 that he circulated informally and “to colleagues I wanted to annoy.”* A little while after he had written this paper, he met two young researchers who were familiar with Kahneman’s and Tversky’s notion that what the rational model would view as anomalous behavior is often normal behavior. It is the rationally reached decision that is the exception.

One of these young men sent Thaler a Kahneman and Tversky paper called “Judgment Under Uncertainty: Heuristics and Biases,” later published as the introduction to a book by that name Kahneman and Tversky had edited.¹¹ Thaler says he could hardly contain himself after reading this article. A year later, he met Kahneman and Tversky, and he has followed in their path ever since. At latest count, he is the author or coauthor of four authoritative books on Behavioral Finance, including *The Winner’s Curse: Paradoxes and Anomalies of Economic Life* and *Quasi-Rational Economics* as well as countless articles.¹²

Thaler’s views on rationality are consistent with Kahneman’s and Tversky’s, but his language is more colorful than theirs. When Kahneman says: “I am now quick to reject any description of our work as demonstrating human irrationality. When the occasion arises, I carefully explain that research on heuristics and biases only refutes an unrealistic conception of rationality, which identifies it as comprehensive coherence,” Thaler puts it this way: People are not “blithering idiots” but they are a long way from “hyperrational automatons.”

In 1957, Nobel Laureate Herbert Simon proposed a calmer and more elaborate development of Thaler’s distinction between blithering idiots and hyperrational automatons. Simon called his concept “bounded rationality.”¹³ From this perspective, people facing an uncertain future *aim* to reach rational decisions, but they often fail because the demands

*See note 6 to Chapter 17 of Bernstein (1996) and Thaler (1991).

of the process are too great and the variety of possible outcomes too bewildering. Rational analysis will always find a solution. In more recent work, Kahneman has placed much emphasis on Simons's conceptual work in this area.



Thaler has also put his money where his mouth is. He is a principal in an investment management firm known as Fuller & Thaler, a partnership with Russell Fuller, another enthusiast for Behavioral Finance who has been Chairman of the Finance Department at Washington State University, author of an investment textbook, and a Wall Street security analyst. Daniel Kahneman is an outside director of the firm.

The investment results at Fuller & Thaler are worth a careful look, because here is Behavioral Finance in action under the guidance of the stars of the field. The firm attempts to achieve above-market returns by seeking opportunity where investors overreact to negative information or underreact to positive information. They combine this basic approach with old-fashioned fundamental research and security analysis.

The firm offers a number of different strategies, ranging from large-capitalization equities down to equities in the smallest-capitalization group, called micro-cap, as well as international strategies investing in companies in both large- and small-capitalization sectors. It also offers a U.S. Large-Cap Market Neutral strategy and an international long/short strategy. The heaviest concentration is in the small-capitalization sector overall.

Although the firm had only \$4 billion under management at the end of 2005, its track record has been impressive. As of September 30, 2006, all but two of these strategies had outperformed their benchmarks (usually market indexes) by significant margins, and the two that fell behind their benchmarks have been operational for a relatively short time. Sharpe ratios (total return divided by volatility) compare favorably in all cases.

The five strategies in operation for the longest periods of time (and their dates of inception) have been Small Mid-Cap Growth Equity (1992), Small Mid-Cap Core Equity (1996), Small-Cap Value Equity (1996), Large-Cap Market Neutral (2000), and Micro-Cap Equity (1999). They show the following rates of return, after all fees from inception

through the third quarter of 2006, compared to their appropriate benchmarks (which pay no fees):

| | Percent per Year | | | |
|-----------------------------|------------------|-----------|---------------|--------------------|
| | Strategy | Benchmark | Excess Return | Years Outperformed |
| Small Mid-Cap Growth Equity | 15.7 | 8.4 | +7.2 | 10/15 |
| Small Mid-Cap Core Equity* | 14.9 | 11.4 | +3.5 | 6/11 |
| Small-Cap Value Equity | 17.2 | 13.4 | +4.5 | 6/11 |
| Large-Cap Market Neutral | 6.2 | 3.0 | +3.2 | 6/7 |
| Micro-Cap Equity | 26.6 | 8.4 | +18.2 | 6/8 |

* All facts and data relating to the performance of Fuller & Thaler have been graciously supplied by Russell Fuller.

Net of fees, the Micro-Cap strategy has clearly been the most spectacular, with returns of 105 percent in 1993, 94 percent in 1999, and 50 percent in 2001. The other three strategies, however, have also comfortably beaten their benchmarks, outperforming in the majority of years.

At first glance, the evidence in the table is a clear demonstration of the power of applying the principles of Behavioral Finance to the real world of the capital markets. At second glance, however, the picture here is not so clear.

Fuller & Thaler produced its most impressive results in the markets for companies with small capitalizations, those ranging from \$50 million to \$4 billion in market value. In contrast, the average capitalization of the 500 companies in the Standard & Poor's Index as of mid-2005 was over \$20 billion; half the S&P companies have market values of more than \$10 billion; the smallest company is capitalized in the market at over \$500 million. This is the pool from which most large and institutional investors select their equity holdings.

There is a lot of evidence to show that the smaller-capitalization sectors are less efficient than the larger-capitalization sectors, in the sense that over- and undervaluation may be greater and can persist for a longer time in markets where most investors are relatively uninformed and untrained, and where relatively high transactions costs can cut deeply into expected returns. Furthermore, the amount of stock available in Fuller & Thaler's favorite hunting ground is much too limited for large investors to be able to trade there. Fuller & Thaler looks smart—and is smart—but

the firm has minimal competition in seeking out opportunity. It has also been careful to avoid putting too much money where it could end up spoiling their efforts: Micro-Cap is closed to new investors and, as of mid-2005, the three small-cap strategies were reported as “close to their natural capacity.”¹⁴

Fuller & Thaler has recently begun to move into the larger-capitalization sectors, international investing, and long/short strategies with encouraging results, but the time period may have been too short to reach any strong judgments about what it has been able to accomplish. As its U.S. Large-Cap Market Neutral strategy has had good success, albeit launched only recently in 2000, the experience is encouraging in both the large-cap strategies and long/short strategies.

In the end, an important question remains unanswered. Have Fuller & Thaler established this track record because of their sensitivity to behavioral anomalies? Or did their long study of behavioral anomalies give their firm a sharp eye for value, which means assets are underpriced but not necessarily as a result of the foibles of less-than-rational investors? There is no way to develop a definitive answer to these questions.

Nevertheless, the questions themselves are too important to be dismissed without further investigation and argument. We conduct that exploration in the next chapter.