Bubble Psychology

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During the last 20 years, it has become apparent to everyone—individual and institutional investors, money managers, academicians, and policymakers—that we know far less about the behavior of financial markets and asset valuation than it was thought earlier.

In retrospect, perhaps the most striking development was strong and unanticipated price volatility in stock, bond, currency, and real estate markets. The performance of equity markets in particular left many intelligent people in disbelief. The powerful rise and subsequent decline of these markets in the United States, Europe, and Japan was a humbling experience, both in terms of discredited theory and practical challenge. Asset price bubbles are worrisome because they misallocate scarce resources and because they may lead to economic stagnation. Even if a bubble at first remains confined to one sector, contagion and spillover effects can cause further damage. Bubbles also redistribute wealth. Sometimes, good people get hurt. Financial earthquakes undermine the public's trust in the integrity of the market system.

Although movements in interest rates played a role in stock market instability, changing forecasts of economic prospects were the main source. Much of what happened during the 1980s and the 1990s was not forecasted, and much of what was forecasted did not happen. As always, the quality of judgment was the most critical factor in asset valuation. After all, "what is news" depends on the expectations embedded in prices.

Of course, it is difficult to identify a stock market boom, *ex ante*, as "a bubble that is about to burst." One of the lessons from history is that even very impressive changes in stock prices elude easy interpretation. Yet, during the 1980s and the 1990s, the collective judgment of the investing public went wrong in many ways. We certainly know so, *ex post*, with the benefit of hindsight. Consider, for instance, the multitude of financial myths surrounding the technology boom in the United States. Until a year ago, it was said confidently that high-tech companies would generate breathtaking, accelerating gains in economic productivity. It was said that, in the valuation of

high-tech firms, the outlook for growth mattered more than did immediate earnings. It was said that some of these firms were already monopolies, with unbeatable advantages, and that they were not subject to the business cycle. High-tech companies, for all these reasons, were touted as superior investments. Across the nation, many financial advisers convinced their clients that there was "no price too high" to pay for a good high-tech company.

In academic finance, the most striking development of the last two decades was how dearly held notions of market efficiency, the positive relationship between return and nondiversifiable risk, and dividend discount models were put into question. For instance, it appeared that the volatility in equity returns could not readily be rationalized by subsequent movements in dividends and interest rates (Shiller, 1989). The long-term return premium of equity over bonds was a second much investigated puzzle. Among others, investor myopic loss aversion seemed a plausible explanation. It also became clear that, in the cross section of stocks, returns were somewhat predictable—but not by beta as the capital asset pricing model suggests. In the time-series dimension, many studies documented short-term reversals, intermediate-term momentum, and long-term reversals in stock prices, all in contradiction to the random walk hypothesis (De Bondt, 2000).

Where do these developments leave us today? Surely, with more respect for the traditional view that price and value are not always one-and-the-same thing. "The stock market is not a weighing machine, on which the value of each issue is recorded by an exact and impersonal mechanism. Rather [it] is a voting machine, whereon countless individuals register choices which are the product partly of reason and partly of emotion," said Benjamin Graham and David Dodd in *Security Analysis* (1934). Indeed, as long as there have been organized stock markets professional traders have emphasized the psychology of investors, market imperfections, and the limits of rational arbitrage (Mackay, 1841; Harrison, 1998; Chancellor, 1999). Investment decisions, John Maynard Keynes (1936) declared, are motivated by "animal spirits." He went on to portray the stock market as a beauty contest. Maybe, through careful fundamental analysis, some investors can pin down the intrinsic values to which prices gravitate in the long run. In the near term, however, such calculations may well be fruitless. Crowd sentiment has its own dynamics, and the "state of the market" drives a wedge between price and value. Money managers can choose to ignore these realities but they do so at the peril of their own jobs. According to Keynes, "There is nothing so dangerous as the pursuit of a rational investment policy in an irrational world."

1. Modern Finance

Contrary to the understanding of Keynes, Graham, and Dodd, and most practitioners, modern finance was built on the twin assumptions of "perfect markets and perfect people." Markets are efficient.[1] In its most stringent form, this paradigm takes a purely functional approach and dismisses institutional arrangements as neutral mutations—ultimately irrelevant to economic outcomes. Modern finance also snubs the human factor. It was conceived as a logical, normative model of an idealized decisionmaker. All behavior is reduced to the axioms of rationality that define *economic man*, that is,

expected utility maximization, risk-aversion, rational expectations, and Bayesian updating. Under complete rationality an individual is able to view the full consequences of each possible action at once and choose objectively what is best for him or for her. In other words, the theory does not treat cognition as a scarce resource. Herbert Simon (1983) calls this approach "the Olympic model."

The rational paradigm fails in at least two major ways. First, as mentioned, its predictions of market behavior prove unsatisfactory. In an interview with *The Economist* (April 23, 1994), Merton Miller admitted this lack of success with unusual candor. He stated, "The blending of psychology and economics ... is becoming popular ... because conventional economics has failed to explain how asset prices are set." (Indeed, a series of well-documented anomalies first brought to light by behavioral hypotheses now dominates asset pricing research.) A second failure of the rational paradigm is that the underlying assumptions are descriptively false. Few people, it turns out, are Olympians. This is easily seen in laboratory experiments. For instance, risk-taking depends at least as much on situational as on personality factors. Or, contrary to the principle of "decision frame invariance," alternative descriptions of an identical problem give rise to different choices (Tversky and Kahneman, 1986). Subjects in many cases willingly violate the axioms of rationality. The normative logic of choice, therefore, may not be a suitable starting point for a descriptive theory of decisionmaking. The deviations from that model are widespread, systematic, and fundamental. What we need, it seems, are new descriptive theories of financial behavior and asset pricing.

2. Behavioral Finance

The new field of behavioral finance takes up this challenge. It is the study of financial decisionmaking with the help of concepts borrowed from psychology. Behavioral finance follows an empirical, inductive approach. It is built on the notion of "bounded rationality" and it focuses on observed behavior. Of course, what an individual does may be very different from what, in principle, he should do. Richard Thaler and myself (1995) and Karl-Erik Warneryd (2001) offer surveys of the literature. The central insight of behavioral finance is that "decision processes shape decision outcomes." If we want to understand and influence what people do, we better first investigate how people think. Under bounded rationality, the decisionmaker does not contemplate in every instant the whole range of possible actions that lie ahead. People are human. Their "true nature" is such that attention, memory, habit, social influences, emotion, visceral responses, and task complexity all contribute to decision processes. For instance, when people move to a new city, most stop searching for an apartment when they find one that satisfies their needs. They do not optimize in a literal sense. Suboptimality in decisionmaking is usually traced to one of three sources: problems of cognition, emotions (for example, wishful thinking), and conformism. My discussion below centers on cognitive issues—mostly relating to the psychology of judgment.[2]

A simple way to think about investment decisionmaking is as a series of present value calculations. Everything depends on the expected future cash flows, the opportunity cost of capital, and the required investment. Of course, it may be very difficult

to get an accurate estimate of, say, the earnings of a telecommunications company five years from now. Actions depend on beliefs, however. The questions "how intuitive forecasts are made" and "how sophisticated man, as an intuitive statistician, really is" are fundamental.

The psychological research has produced some disheartening results. (For a literature review, see Gilovich, 1991.) For instance, simple regression models that capture an individual's weighting policy for major predictor variables and that apply it consistently often lead to better forecasts than the subject himself. This phenomenon occurs because any misconception that the subject has is less detrimental than his inconsistencies in applying a given decision rule (Dawes, 1979). Outcome feedback often induces response inconsistency and it may not help accuracy. Neither does prediction accuracy improve with experience, incentives, and the amount of available information. Many experts falsely believe that they can beat decision rules, which yield the correct choice in a large proportion of cases. Highly motivated subjects grow impatient. They do not easily tolerate errors without resorting to a strategy shift. Finally, the prime effect of extra information is to make the subjects feel more confident, without improving the quality of their judgment (Oskamp, 1965). More generally, people are prone to experience confidence in highly fallible judgments.

Two significant concepts relating to "how people think" are mental frames and heuristics. In the first instance, most reasoning occurs with the help of *mental frames*. A frame refers to the decisionmaker's simplified perspective on a complex real world problem, that is, his conceptual model. The frame defines how the problem is formulated and how actions and outcomes are experienced relative to certain aspiration levels. In many cases there is no unitary model of truth, even though there are degrees of knowledge. (For instance, by and large, company hiring practices reflect the belief that good university students become productive employees. This intuitive theory may well be correct although I cannot offer evidence.) As a rule, the tacit models that people use are fluid; they can be misleading, and they need not be internally consistent. Much of what people know they accept on faith. (Is milk rich in calcium? Is Chile a country in South America? Are stocks the best investment for the long run?) Every newborn child cannot possibly recreate from scratch all of our collective knowledge about the universe. Mental frames are socially shared. To a significant degree, they are fabricated by educators, opinion leaders, and men in advertising. ("At Ford, quality is job one.")

Precisely because our intuitive knowledge structures are influenced by what others say and do, we are social animals. Mental frames have great influence. When people interpret their lives or look for guidance, impressions of this kind may well trump experience and logic. Sometimes, there is no alternative. Major personal decisions, say, relating to career choices, are not repeated so often that people can learn much from their own experience. What is troubling, however, is that many frames are both mistaken and resistant to change. Ideally, we would like to understand the sources of illusions and the mind processes that sustain them. In fact, all the pseudo-science, myth, and superstition that envelop us (say, on the benefits of herbal medicines) seem to disprove the descriptive relevance of the economic concept of rational expectations. The issue is not easily reduced to a debate about learning. Self interest matters,

too. For instance, pressure groups in society spend large sums of money to shape the content of news reports. To create a world dominated by particular problems is to create support for particular solutions. Marcia Angell (1996) analyzes the clash between law and junk science in the breast implant case and the economic interests that motivate it. Elaine Showalter (1997) studies chronic fatigue, Gulf War, and other syndromes as imaginary epidemic illnesses of the 1990s.

Heuristics are shortcuts for coping with new information. Generally, heuristics produce the desired outcome but, on occasion, they lead to foreseeable errors in judgment. Few people are aware of these biases. In a series of classic papers (reprinted in Kahneman et al., 1982), Amos Tversky, Daniel Kahneman, and others analyzed three major rules of thumb: representativeness, availability, and anchoring-and-adjustment. Judgment by *representativeness* occurs when people assess the likelihood of an event by its superficial similarity to a well-known stereotype. The unjustified neglect of base rates that follows implies that man can hardly be viewed as a Bayesian decisionmaker. Representativeness also supports the mental structuring of random sequences, and it explains the failure to appreciate the statistical phenomenon of "regression-to-the-mean." These experimental findings motivated the original studies of stock market overreaction. Judgment by *availability* takes place whenever a probability is judged by vividness and by the ease with which an event is brought to mind. The *anchoring-and-adjustment* heuristic explains the power of first impressions. People start from an initial value and adjust if to yield an inference, but the adjustment is typically insufficient so that different anchors produce different conclusions. People, we find, are active interpreters of new information; that is, they constantly go beyond the data that are given. Hence, human cognition is conservative. Beliefs tend to sustain themselves despite evidence to the contrary.[3]

3. Financial Behavior

I have described some of the nonreflective strategies that people use in intuitive judgment. It is of decisive importance to establish that these strategies, and the biases associated with them, influence day-to-day decisionmaking. For this reason, behavioral finance has collected many new facts about how financial forecasts are made, how portfolios are managed, and how stocks are traded.[4] Below, I briefly illustrate some of the new findings as they relate to the behavior of amateur investors (also called noise traders) and experts (security analysts).

In prior work (1998), I have sketched "a portrait of the individual investor." The portrait is unimpressive. I list four classes of anomalies relating to irregular perceptions of the dynamics of equity prices, perceptions of value, risk management, and trading practices. Perhaps the best-established stylized fact is that many investors see price patterns where there are none. In various ways, traders take pains to justify their decisions.[5] There is a strong extrapolation bias, that is, the expected continuation of past price changes, as well as a strong optimism bias.[6] Subjective perceptions of price variability are typically too narrow. This reflects overconfidence. Perceptions of value depend in large measure on popular models, that is, what is in fashion. Many people do not distinguish between good stocks and good companies. They are also willing to

pay more for assets that are familiar to them and, therefore, make them comfortable. What is surprising is the failure to infer basic investment principles from years of experience, for example, the benefits of diversification. It is widely believed that risk can be managed by knowledge and trading skill after funds have been committed. This encourages investors to put their wealth in relatively few assets.[7] Finally, while some investors procrastinate and others trade too much, nearly all have a psychological aversion to realize losses. Some investors tend to take gains on past winner stocks early.

Many studies have examined the quality of security analysts' stock recommendations and earnings forecasts (see, for example, De Bondt and Thaler, 1990; De Bondt and Forbes, 1999). On the whole, these studies find that the analysts are decidedly human. The data suggest 1) excessive optimism (for example, "low" earnings forecasts are often more accurate than the consensus), 2) excessive use of popular models (that is, forecasts of earnings changes that are too extreme, up or down, especially for long-term predictions), 3) excessive confidence, 4) excessive rationalization (that is, the tendency to give too little weight to earnings news and to miss turning points), and 5) excessive agreement among analysts (that is, herding behavior). The range of forecasts, in the cross section of analysts, is surprisingly narrow. Most actual earnings per share numbers fall outside the range of the "high" and "low" forecasts. Yet, agreement among analysts is always so strong that it barely increases further as we get closer to the time of the earnings announcement.

4. Market Behavior and Asset Price Bubbles

Besides decision anomalies (seen in experimental data) and anomalies in financial behavior (seen in survey and trading data), behaviorally inspired research has also discovered a list of market anomalies, for example, the long-run underperformance of initial public offerings, excess volatility in stock prices, the predictive power of the book-to-market value ratio in the cross section of asset returns, intermediate-term price momentum, and long-run price reversals (the winner-loser effect) (for a survey, see De Bondt and Thaler, 1995). All these findings support the view that investor psychology influences stock returns and that sophisticated agents may benefit in a methodical way from other people's cognitive and emotional shortcomings.[8] I (De Bondt, 2000) show that many of the results first established with U.S. data also hold in international markets.

What causes predictable momentum and reversals in stock prices? The most likely explanation is that analysts and traders naïvely extrapolate past earnings trends.[9] Investor under- and overreaction may be accounted for by the unwarranted use of stereotypes. For instance, investors freely talk about "growth firms" and "declining industries" even though annual earnings changes provide little evidence of reliable time-series patterns (except for reversals in the tails of the distribution). All too often, the life-cycle metaphor proves persuasive. No wonder, then, that when an earnings surprise hits, many traders refuse to believe it. Underreaction occurs when new evidence runs counter to a firmly held view. People persevere in their beliefs. They filter the data to confirm what they think they already know. Consistent with this interpretation

of the data, three- to five-year stock market losers are more likely than not to experience subsequent positive earnings surprises, and past market winners are more likely than not to report subsequent negative surprises.

Modern finance has responded to the new facts in different ways. It either reinterprets them as nonanomalous (for example, the abnormal profits compensate for time-varying risk), it questions their pervasiveness and robustness (Fama, 1998), or it argues that markets may yet be minimally rational, in the sense that markets fail to supply opportunities for abnormal profits. The most common counterargument is rational arbitrage. "Even if we accept the notion that many investors misinterpret the news," it is said, "a relatively few individuals sensitive to arbitrage may make markets work as the standard theory predicts." My reading of the literature is that there are no compelling reasons to give that argument decisive weight (for a lengthy discussion, see Brunnermeier, 2001).

One way to think about the matter is to ask for the minimal set of restrictions on heterogeneous beliefs and information sets that even in frictionless markets are necessary for the existence of rational, arbitrage-free equilibrium prices. Russell and Thaler (1985) and others show that investors are not allowed to form different opinions based on the same substantive information. They must agree on the value implications of any conceivable state. When there is such divergence of opinion, rational prices may yet prevail if, at some future time, the true mapping of events into value is revealed to all and if, in the meantime, only rational investors sell short. Neither of these assumptions applies to the stock market.

Institutional factors, such as short sales constraints or capital gains taxes, are likely to change the situation for the worse rather than for the better. In a world with nontrivial trading costs and heterogeneous beliefs, every individual not only chooses the size of his holdings in each asset but also in which assets to invest. Equilibrium involves the simultaneous determination of asset prices and the identity of investors trading in each asset. Some economic agents never reveal their information via trade, except by abstaining. As a result, market prices cannot reflect it (Mayshar, 1983).

A pure arbitrage opportunity does not exist unless it is certain that share prices will eventually revert to their fundamental underlying values. However, to affect prices, investors with superior forecasting ability or with inside information must assume increasing amounts of diversifiable risk. In practice, arbitrageurs face financial constraints (Shleifer and Vishny, 1997). Second, it may be rational for these traders to ride the trend rather than to go against it. Third, the resilience of a bubble may stem from the inability of rational arbitrageurs to coordinate their selling strategies. Fourth, a market may rationally launch itself onto a speculative bubble with prices being driven by an arbitrary self-confirming element in expectations (Tirole, 1982). There is no choice-theoretic rationale for singling out equilibrium price paths that do not suffer this extrinsic uncertainty.

What are the common behavioral elements in the various interpretations of asset price bubbles? To answer that question, I go back to Charles Kindleberger's (1978) scenario of the canonical financial crisis. In the prelude to crisis, Kindleberger distinguishes three stages: 1) an economic shock that reflects structural change outside the experience of most people and that objectively justifies higher prices (a "new era");

2) rising investor confidence, leading to the increased use of leverage and speculative instruments; and 3) a herding effect, where demand increases because prices are going up. Similarly, when the bubble bursts, an outside shock first reduces demand. Next, prices drop more as demand slows because even lower prices are expected in the future. The central puzzle is the excessive optimism and overconfidence that start the cycle, as well as the positive feedback trading that keeps it going. After the success stories have become widely known and accepted by the public, unrealistic hopes for rapid wealth accumulation draw many newcomers into the market. These players tend to naïvely duplicate strategies that produced high profits in the past. An interesting aspect of herding behavior is the illusion of universal liquidity, that is, the belief of any individual trader that in a downturn he will be able to get out while others take losses.[10] Surveying bubbles from the 17th century to the 1987 crash, White (1990) concludes: "The principal factor that leads to [their] emergence ... is that the ... fundamentals of the assets ... cease to be well identified. Another feature ... is the appearance of ... inexperienced investors." Shiller (2000) also defends the feedback theory. He ascribes a prominent role to the mass media in the Internet bubble. Evidently, many other self-interested parties (top managers, auditors, investment bankers, analysts, brokers, lawyers, and politicians) stoked the fire.

5. Conclusion

Much is learned about the behavior of investors and markets by studying how people solve financial problems. Substantively, behavioral finance shows that:

1. *Intuitive judgment is fragile*. Basic investment principles, such as portfolio diversification, are not learned from everyday experience. In fact, as the Enron debacle and recent accounting scandals show, many investors are financially illiterate. The timely, full, and transparent disclosure of information helps to maintain trust in the capital markets, but, by itself, may not be enough. Because the state at present plays a lesser role in protecting people from the hazards of life (for example, sickness and old age) than it did before, financial education and easy access to reliable, independent financial advice are important agenda items for policymakers.[11]
2. The *speculative dynamics of stock prices* are broadly consistent with the position taken by Graham and Dodd (1934) that, in the long run, prices gravitate to economic fundamentals but that, in the short run, investor psychology may drive a wedge between price and value. The valuation errors of noise traders create risk but they may be a profit opportunity for sophisticated, patient investors.

Behavioral finance has already proved itself to be a productive, pragmatic, and intuitive approach to asset pricing research. With its requirement of realism in assumptions, behavioral finance also brings discipline to financial modeling.[12] Some financial economists continue to favor, on an *a priori* basis, models with rational agents only. Fama (1998) and others worry that researchers will arbitrarily pick and choose from a list of psychological biases in order to behavioralize market anomalies. Depending on the anomaly, at least one bias will inevitably fit the facts. I very much share their

concern. If carefully defined, however, psychological biases are probably not as slippery a concept as rationality. In principle, laboratory, survey, and market data can falsify the hypothesis at hand.

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Notes

1. In answer to the question "What did we learn from the [1987] crash?" Fama (1989) replies: "The market moved with breathtaking quickness to its new equilibrium ... its performance during the period of hyperactive trading is to be applauded."

2. Because space is limited, I will not discuss the psychology of choice, for example, prospect theory, loss aversion, procrastination, hyperbolic discounting, self-control, habit formation, and so on. See Warneryd (2001).

3. As early as 1620, in *Novum Organum*, Francis Bacon stated that "The human understanding supposes a greater degree of order and equality in things than it really finds; and although many things in nature be sui generis and most irregular, will yet invest parallels and conjugates and relatives where no such thing is."

4. Many people believe that they can benefit from this enterprise, including individual investors, financial planners, money managers, and executives who manage earnings with an eye towards the firm's stock price. The list even includes central bankers. In the arsenal of monetary policy tools, Federal Reserve Chairman Alan Greenspan's spoken words are arguably among his most powerful weapons. The pragmatic purpose, of course, is to make better decisions. (Modern finance has no comparable agenda since it starts from the premise that investors already know what is best.) Paul Slovic (1972) states it well when he writes: "A full understanding of human limitations will ultimately benefit the decision maker more than will naïve faith in the infallibility of his intellect."

5. "Even when the underlying motive of purchase [of common stocks] is mere speculative greed, human nature desires to conceal this unlovely impulse behind a screen of apparent logic and good sense," (Graham and Dodd, 1940).

6. See, again, Francis Bacon (1620): "Man prefers to believe what he prefers to be true."

7. Even Warren Buffett, not exactly an amateur trader, seems to fall into this trap: "We believe that if you are a know-something investor, able to find five to 10 sensibly priced firms that possess important long-term competitive advantages, then conventional diversification makes no sense for you. It is apt simply to hurt your results and increase your risk. I cannot understand why an investor of that sort elects to put money into a business that is his twentieth favorite rather than simply adding money to his top choices—the businesses he understands the best, and that present the least risk, along with the greatest profit potential," (Berkshire Hathaway Annual Report, 1993).

8. In his *Primer on Political Economy* (1878), William Stanley Jevons also suggests a link between investor psychology and asset pricing—in particular, between herding behavior and the apparent profitability of contrarian investment strategies. He states: "As a general rule, it is foolish to do just what other people are doing, because there are almost sure to be too many people doing the same thing."

9. Alternative, not mutually exclusive, explanations include systematic biases in risk perception and trading that is motivated by what is happening in the market rather than changes in economic fundamentals, for example, program trading and portfolio insurance.

10. One interpretation of this behavior is excessive risk-taking or recklessness. Frank Knight (1921) emphasizes, however, that the risk does "not relate to objective external probabilities, but to the value of judgment and executive powers of the person taking the chance ... Most men have an irrationally high confidence in their own good fortune, and that is doubly true when their personal prowess comes into the reckoning ... To these considerations must be added the stimulus of the competitive situation, constantly exerting pressure to outbid one's rivals ... Another ... factor is the human trait of tenacity ... once committed, ... the general rule is to hold on to the last ditch," (pp. 365–366).

11. Successful wealth management requires a structured and disciplined framework. The rationality of many social systems—either purposively designed rules and regulations, or spontaneous market mechanisms— transcends individual rationality. The Swiss Henri-Frederic Amiel said it best: "L'experience de chaque home se recommence. Seules les institutions deviennent plus sages." (Translation: "The experience of every person starts anew. Only institutions become wiser.")

12. Consider, for instance, the case of stock market overreaction. The arguments in favor are at three distinct levels. First, in experiments, subjects behave as predicted by the representativeness heuristic. Second, survey and trading data confirm that most investors love past winner stocks and hate past losers. Third, at the market level, price reversals are observed.

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