CHAPTER 2
The Mind of the Investor

A. Introduction to Market Efficiency

An Efficient Capital Market is defined as a market where security prices reflect all available information. More formally, one can state that in an efficient market, the current price of a capital asset reflects the consensus evaluation of the market:

$$E[\widetilde{P}|\phi,\phi_k] = E[\widetilde{P}|\phi]\forall k$$

where $E[\widetilde{P}]$ is the price of the asset, ϕ is the set of information available to all participants in the market, ϕ_k is the info available to individual k.[1] This statement implies that a given individual k's information set ϕ_k not shared with the market does not improve his estimate of expected price in an efficient market; the market price already reflects all relevant information ϕ. In a perfectly efficient market where security prices fully reflect all available information, all security transactions will have zero net present value.

One cannot realistically expect that markets to be perfectly efficient; however, it is interesting to study the level of efficiency in markets. For example, what type of information is reflected in security prices? What is the speed of information flow? How much time is required for a particular type of information to be reflected in security prices? Does market reaction to new information (or lack thereof) reflect rational self-serving behavior on the part of investors? If markets are perfectly efficient with regard to a given type of information, investors cannot use this type of information to gain higher than normal returns; the information is already reflected in security prices.

If markets are perfectly efficient, then, by definition, securities reflect all available information. One might argue that security prices will fluctuate only as new information is realized by the market. New information might be expected to occur randomly, otherwise it is not really new. Thus, one might expect prices in an efficient market to fluctuate randomly. Samuelson [1965] formalizes this argument in his paper entitled "Proof that Properly Anticipated Prices Fluctuate Randomly." Thus, many tests of market efficiency are concerned with the extent to which security prices fluctuate randomly. Furthermore, since prices properly reflect all that investors know about securities, all transactions, on an ex-ante basis, will have zero net present value in an efficient market.

While one might argue that market efficiency is the necessary product of rationality and greed, and that market survival requires these characteristics of investors who determine price-setting, we will present an argument later that market efficiency will cause financial markets to fail. Furthermore, we will present arguments later that predictable prices may be perfectly consistent with market efficiency when investors are risk-averse and in certain other circumstances.

[1] Some formal-looking mathematical notation will be presented in this chapter. Don't let it worry or confuse you.

B. Rational Investor Paradigms

Most financial models assume that all investors and all corporate managers are rational individuals that prefer more wealth to less and seek to maximize their wealth. Rational investors process information efficiently and use it to maximize their wealth. But, do stock investors really behave this way? Should they? The theories and models of efficient capital markets all draw from the assumption that investors are greedy, rational, and can access and exploit new information efficiently. By greedy, we mean that investors will strive to maximize their wealth. By rational, we mean that investors can efficiently process and use all information to maximize their wealth. Such assumptions may be quite reasonable, at least to an extent, and allow for simpler and more straightforward model building. The efficient market theories are attractive, in part, because they facilitate financial model building. Financial model-builders can treat investors as participants in a mathematical game if investors' behavior is rational. Models based on rational behavior are usually less contrived, easier to create and more believable than theories based on irrational behavior. However, ask yourself how many investors you know that are truly rational. As reasonable as the rationality assumption might seem, and as compelling as the models that it leads to are, does it really reflect the mind of the investor? This chapter explores the extent to which investors might not be rational and how such deviations from rationality might affect financial markets. Experiments by psychologists (and perhaps our own observations of market behavior) suggest that the "rational man" assumption is not fully justified. Behavioral finance is concerned with the actual behavior and thinking of individuals who make financial decisions.

The St. Petersburg Paradox and the Expected Utility Paradigm

Over 250 years ago, a mathematician named Daniel Bernoulli reasoned that a rational gambler should be willing to buy a gamble for its expected value. For example, it seemed rational for a gambler to invest up to $1 for a gamble that paid either $2 or zero based on the toss of a coin. He then extended his reasoning to a series of coin tosses, presenting his paradigm in 1738 at a conference of mathematicians in St. Petersburg. His extended problem, commonly referred to as the St. Petersburg Paradox, was concerned with why gamblers would pay only a finite sum for a gamble with an infinite expected value. Suppose, in Bernoulli's paradigm, the coin lands on its head on the first toss, the gamble payoff is $2. If the coin lands tails, it is tossed again. If the coin lands heads on this second toss, the payoff is $4, otherwise, it is tossed a third time. If the coin lands heads on the third toss, the payoff doubles again to $8; otherwise, it is tossed again for a potential payoff of $16. The process continues until the payoff is determined by the coin finally landing heads. Where n equals infinity, the expected value of this gamble is determined by the following equation:

$$E[V] = (.5^1 \times 2^1) + (.5^2 \times 2^2) + (.5^3 \times 2^3) + \ldots + (.5^n \times 2^n)$$

This equation is based on the expectation that the probability of the coin landing heads on the first (or any) toss equals .5. If the coin lands heads on the first toss, the payoff equals $2 = 21. Since there is a fifty percent chance the coin will land tails on the first toss and a fifty percent chance the coin will land heads on the second toss, the probability of achieving a payoff of $4 = 22 on the second toss is .5 · .5 = .52. Thus, the probability of having a payoff equal to 2n = .5n. The expected value of the gamble equals the sum of all potential payoffs times their associated

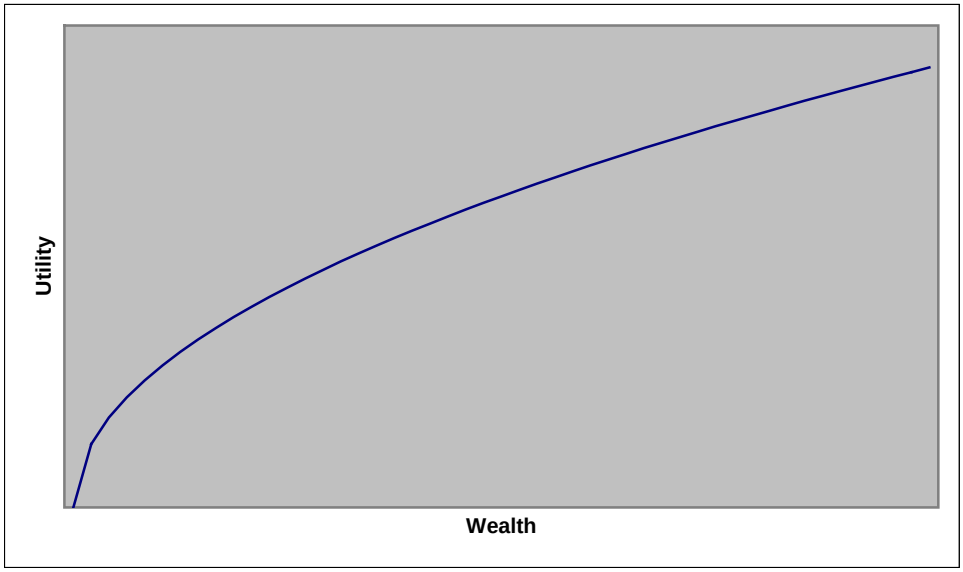
probabilities. So, exactly what is the expected value of this gamble? We simplify the equation above as follows:

$$E[V] = (.5^1 \times 2^1) + (.5^2 \times 2^2) + (.5^3 \times 2^3) + \ldots + (.5^n \times 2^n)$$
$$E[V] = (.5 \times 2) + (.5 \times 2) + (.5 \times 2) + \ldots + (.5 \times 2)$$
$$E[V] = (1) + (1) + (1) + \ldots + (1)$$

It appears, since there is some possibility that the coin is tossed tails an infinity of times, the expected or actuarial value of this gamble is infinite. This seems quite obvious from a mathematics perspective. Paradoxically, Bernoulli found that none of the esteemed mathematicians at the conference would be willing to pay an infinite sum (or, in most cases, even a large sum) of money for the gamble with infinite actuarial value. Were the mathematicians simply irrational? Or, should the worth or market value of a gamble or investment be less than its actuarial or expected value.

Bernoulli opined that the resolution to this paradox is the now commonly accepted notion of "diminishing marginal utility," which holds that as the wealth of a person increases, the satisfaction that he derives increases, but at a lesser rate (See Figure 1). More money produces more satisfaction, but the rates of increase in satisfaction are less than the rates of increase in wealth. So the worth of a gamble to an investor is less than its expected value because the utility derived from each dollar of potential gains is less than the utility of each dollar potentially lost. Bernoulli proposed a log-utility function where an individual's level of satisfaction derived from wealth is related to the log of his wealth level. The key to this utility function is that satisfaction increases as wealth increases, but at a lesser rate. This means that, an investor stands to lose more satisfaction in an actuarially fair gamble than he stands to gain. The potential loss in a "double-or-nothing" bet is more significant than the potential gain. Thus, investors will reject actuarially fair gambles because, on average, they lose satisfaction of utility.

Figure 1: Utility of Wealth
U = *ln*w



The implication of the utility function is that rational investors should seek to maximize

the expected utility of their wealth, not their expected wealth itself. Furthermore, this theory of utility can serve as the theoretical foundation for risk aversion. Thus, rational investors can be motivated not only by greed, but by fear as well.

Von Neuman and Morgenstern: Axioms of Choice

In their seminal treatise on Game Theory, John von Neumann and Oscar Morgenstern [1947] present a set of behavioral assumptions (axioms) that we will adapt and use to derive the Expected Utility Hypothesis. We shall start by assuming that investors make investment selection x_i from a convex subset **x** of the n-dimensional Euclidian space $\Re^n$.[2] The element x_i represents the number of units of investment i which can be selected by the investor from the n elements of vector $\mathbf{x} = [x_1, x_2, \ldots x_n]^T$. Convexity of this subset means that the investor can form linear combinations of any elements in **x** to obtain new elements in **x**; that is, for any $\alpha \in [0,1]$, $\alpha x_j + (1-\alpha)x_k \in \mathbf{x}$. The first three axioms ensure investor rationality:

1. *Reflexivity*: For an entire set **x** of investment alternatives x_i, $x_j \succsim x_j$ (x_j is at least as desirable as x_j). This axiom might be regarded as merely a mathematical necessity.
2. *Completeness (or Comparability)*: For an entire set of investment alternatives x_i, either $x_j \succ x_k$ (x_j is preferred to x_k), $x_j \prec x_k$ ((x_j is less desirable than x_k) or $x_j \sim x_k$ (x_j is equally desirable to x_k) for all j and k. Thus, the investor can fully specify his preferences over the entire set of investments.
3. *Transitivity*: For any x_i, x_j , x_k, if $x_i \succ x_j$ and $x_j \succ x_k$, then $x_i \succ x_k$. This axiom ensures consistency among choices.

While the three axioms listed above are sufficient to ensure investor rationality, working with such preference relations is difficult at best when n is very large. Hence, it is useful to develop and apply a rule that assigns values to choices. Such a rule is known as a cardinal utility function. A cardinal utility function assigns a unique number (utility level) to each and every choice (e.g., wealth level, risk/return combination, etc.). Three more axioms are needed to establish a cardinal utility function:

1. *Strong Independence*: If $x_j \succ x_k$, then for any $\alpha \in [0,1]$, $\alpha x_i + (1-\alpha)x_k \sim \alpha x_j + (1-\alpha)x_k$. It may be useful to interpret α as a probability. This axiom implies that preference rankings are not affected by inclusion in more complicated arrangements.
2. *Measurability (or Intermediate Value)*: If $x_i \succ x_j \succ x_k$, then there exists some α such that $\alpha x_i + (1-\alpha)x_k \sim x_j$. This implies non-existence of lexicographic (dictionary) orderings. Lexicographic orderings imply discontinuities in utility functions.
3. *Ranking*: Assume that $x_i \succ x_j \succ x_k$ and $x_i \succ x_m \succ x_k$, and $x_j \sim \alpha x_i + (1-\alpha)x_k$ and $x_m \sim \gamma x_i + (1-\gamma)x_k$ where $\gamma \in [0,1]$. Then it follows that if $\alpha > \gamma$, $x_j \succ x_m$ or if $\alpha = \gamma$, $x_j \sim x_m$.

These six axioms are sufficient to construct a cardinal utility function where utility can be

[2] Don't worry about any complicating-sounding math terms here. We are simply using some language from Game Theory to describe the set of investment choices.

represented with numbers. We shall usually add two more assumptions to this list: (1) Greed: Investors prefer more to less wealth and (2) Risk aversion: Investors prefer certainty to uncertainty (This assumption need not always apply, but it does seem realistic.).

While seemingly complicated, these axioms of choice are the basis for the micro-economics of investment theory. The question we pose in the next section is whether and the extent to which investors actually behave consistently with these axioms.

C. Behavioral Finance

Behavioral finance is concerned with the impact of human emotions and cognitive impairments on investment decision-making. Economists have used expected utility maximization for over two centuries as the presumed objective of the rational investor. Expected utility maximization has served and still serves as the "industry standard" for modeling investor behavior. In this section, we review a number of studies concerning individual and investor rationality. Many of these studies have been conducted by experimental psychologists; most of the remainder are based on statistical analyses of financial data.

Prospect Theory

In the late 1970's, an experimental psychologist named Amos Tversky began to find evidence that investors and gamblers might not behave in a manner consistent with maximizing utility. Amos Tversky, in collaboration with others including Daniel Kahneman (Nobel Prize winner for this body of work) have conducted numerous experiments on subjects testing decision-making characteristics. Generally, these experiments suggest that most subjects are quite irrational and inconsistent in their decision-making. They have also written on applications of their results to financial-decision-making, suggesting that investors may actually be quite different from the theoretical "rational economic man." Kahneman and Tversky were particularly interested in how people made decisions when faced with uncertainty. They called their new perspective *Prospect Theory* (with no particularly good reason). While expected utility maximization focuses on levels of wealth, prospect theory focuses on changes in wealth.

Losses and Inconsistency

Consider the following example choice of gambles:

Gamble A: .33 probability of receiving 2,500, .66 of receiving 2400 and .01 of receiving 0
Gamble B: 100% probability of receiving 2,400

Kahneman and Tversky found that 82% of their experiment participants preferred Gamble B to Gamble A. However, they offered the same set of participants the following second set of gambles:

Gamble A*: .33 probability of receiving 2,500, .67 of receiving 0
Gamble B*: .34 probability of receiving 2,400 and .66 of receiving 0

In the second part of this experiment, 83% of participants preferred Gamble A* to B*. The same change was made to both gambles in moving from the first to second sets; .66 probability was shifted from Gambles A and B to A* and B* from winnings of 2,400 to zero. The gamble shifts were identical, but many participants reversed their preferences. Yet from the first to second sets of choices, the changes to both gambles were identical; losses of 2,400 were imposed on both gambles from the first set to the second set with probability .34. Since the losses were identical, participants should not have reversed their decisions, but, clearly, the majority did. Kahneman and Tversky surmised that people are risk averse when evaluating positive outcomes (winnings), but risk-seeking when evaluating losses. Hence, people have diminishing utility of wealth

functions with respect to winnings, but increasing marginal utility when faced with wealth decreases. Investors seem to exhibit similar reactions to reductions in wealth.

Consider a very simple variation on this problem. One group of subjects was presented with this problem:
1. In addition to whatever you own, you have been given $1,000. You are now asked to choose between:

A. A sure gain of $500
B. A 50% change to gain $1,000 and a 50% chance to gain nothing.

A second group of subjects was presented with another problem.
2. In addition to whatever you own, you have been given $2,000. You are now asked to choose between:

A. A sure loss of $500
B. A 50% chance to lose $1,000 and a 50% chance to lose nothing.

In the first group 84% chose A. In the second group 69% chose B. The two problems are identical in terms of terminal wealth to the subject. However the phrasing of the question causes the problems to be interpreted differently. This leads to the following framing versus substance problem.

Frames versus substance

Determining the preferences of individuals is complicated by their apparently inconsistent responses to questions that are presented to them. These inconsistencies not only make it more difficult to study investor behavior, it makes the problem of offering financial advice rather problematic. For example, Kahneman and Tversky describe how various individuals form decisions when identical questions are phrased differently. In particular, consider the following example when individuals are asked from two different perspectives to select from radiation or surgery for cancer treatment:

Survival Frame
Surgery: Of 100 people having surgery, 90 live through the postoperative period, 68 are alive at the end of the first year, and 34 are alive at the end of five years.

Radiation: Of 100 people having radiation therapy, all live through the treatment, 77 are alive at the end of the first year, and 22 are alive at the end of five years.

Mortality Frame
Surgery: Of 100 people having surgery, 10 die during surgery or the postoperative period, 32 die by the end of the first year, and 66 die by the end of five years.

Radiation: Of 100 people having radiation therapy, none die during treatment, 23 die by the end of one year, and 78 die by the end of five years.

Although the information presented in the "Survival Frame" is identical to that presented in the "Mortality Frame", 18% of respondents preferred radiation therapy when presented with the

"Survival Frame", compared with 44% when presented with the "Mortality Frame." Physicians and statistically trained business students did not react differently from other respondents when surveyed.

Consider an even simpler example (Ritter [2003]. How would you feel about paying a "peak-period surcharge" to dine in a restaurant? How does the pricing scheme for this surcharge differ from an "early bird" or "after-theatre" discount? Presentation does matter. In any case, not only do we have evidence that individual decision-making is inconsistent, but preferences may be inconsistent and individuals irrational as well. Consider this problem in an investments context. How can an investment advisor assess her client's level of risk aversion when the framing of the question affects the investor's response? Can we really expect investors to behave consistently when their risk attitudes change depending how their situations are addressed?

The framing issue presents itself regularly in promotional literature distributed by investment advisors, mutual funds and other financial institutions. Consider the following description concerning corporate annual reports by Beattie and Jones [2000] "measurement distortion can occur through graphical devices such as a nonzero axis or a broken axis, which cause the rate of change in trend lines to appear greater than is actually warranted." Their paper argues that graphs are frequently used selectively and graph formats exploit measurement distortions implying inaccurate depictions of financial performance results than is warranted. Diacon and Hasseldine [2007] find evidence that investors are misled by such distorted displays when selecting investment funds.

Maintaining the status quo: Joe and his Opera Tickets,

The following story was taken from the Wall Street Journal:[3]

> *On the way to the opera, Joe loses his pair of $50 tickets. Most likely, he will not buy another pair - spending [a total of] $200 [including $100 on the lost tickets] to hear "La Boheme" seems a bit much. But suppose, instead, he arrives at the theater tickets-in-hand, but discovers he has lost a $100 bill. He could sell his tickets, which would net him the same result as in the first case - out $100 and out the tickets. But he probably won't sell. ... Joe may think he is entirely rational, but he leans consistently toward the status quo.*

This particular type of bias to maintain the status quo is sometimes referred to as the endowment effect. This effect causes losses or what is given up to weight more heavily in the decision-making process than gains or what is acquired. This effect seems to manifest itself in investing through a seeming reluctance to sell stocks, particularly stocks that have lost value. When one considers the tax write-off implications of selling a stock that has lost value, it generally makes sense to sell "losers" before year's end. However, most investors demonstrate a pronounced reluctance to do so. Investors seem to maintain a status quo even when changing their portfolios would result in increased wealth. Some observers refer to this phenomenon as "fear of regret."

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[3] This article entitled "Intrinsic Value: Outsider who Challenged Dismal Science" by Roger Lowenstein in the June 6, 1996 issue of the *Wall Street Journal* provided a number of examples of the work of Amos Tversky, the Stanford psychologist who studied irrational consumer and investor behavior.

A similar sort of problem exists with "anchoring," where the decision-maker places undue emphasis on some factor, number or measure. For example, Kahneman and Tversky asked participants in an experiment to spin a roulette wheel with numbers from 1 to 100 and then estimate the number of countries in Africa. They found that participants' estimates were unduly influenced by the result of the roulette wheel spin result. Similarly, Genesove and Mayer [2001] found that sellers of houses and apartments tend to be unduly influenced by purchase prices of their homes. Studies have found that amateur traders are more affected by endowment and anchoring effects than professionals.

The Monty Hall Judgment Error

One very interesting experimental study of investor irrationality, failure to learn and market rationality is presented in Kluger and Wyatt [2004]. This problem is adapted from the well-known Monty Hall Problem, based on the late 1960's game show "Let's Make a Deal." In the show, Monty Hall, the show host, would offer contestants an opportunity to choose one prize hidden behind one of three identical doors. Prizes hidden behind two of three doors were worthless (if the contestant selected either of these doors, he was "zonked,") but the prize hidden behind the third was valuable. The contestant would choose the door behind his prize was to be hidden. At this stage in the game, the contestant had a one-third probability of winning the valuable prize. Before allowing the contestant to see whether she had won the valuable prize, and with increasing audience anticipation, Mr. Hall would then typically show the contestant the worthless prize behind one of the two doors that the contestant did not select. He would then offer the contestant an opportunity to switch her selection to the prize behind the third door. Thus, the contestant's problem is whether to stick with her original selection or to switch her selection to the prize hidden behind the third door.

To summarize, the valuable prize is behind one of the three doors. The probability of the contestant having selected the door with the valuable prize was initially 1/3. But, once one of the two worthless prizes is revealed behind a second door, can the contestant improve his odds of obtaining a valuable prize by switching his decision to select the other unopened door?

Regardless of what prize remains behind the first door selected by the contestant, Mr. Hall will reveal the worthless prize behind a second door. Hence, the probability of a valuable prize behind the first door remains 1/3. We know that Mr. Hall will not reveal the prize behind the selected door, so its probability of being the desirable prize is unchanged. The door that Mr. Hall will select to open will have a worthless prize with probability one. This door will not have a valuable prize behind it. What is the probability that the valuable prize is behind the third door? This probability must be 1 - 1/3 – 0 = 2/3. Why? Remember that Mr. Hall will not open a second door with a valuable prize behind it. This doubles the probability that the valuable prize is behind the third door. Hence, the contestant should always switch his selection to maximize his probability of obtaining the valuable prize. Most contestants did not. In fact, most experimental subjects, when provided a description of this problem announce that they will not either (Friedman [1998]). When asked to calculate probabilities, many people will say that the valuable prize is equally likely to be behind the first and third doors, despite the additional information realized when Mr. Hall reveals the prize behind the second door.

Most people have no difficulty estimating that the initial probability of 1/3 for the prize behind any one of the three doors. This heuristic has served most people well for years. However, people tend to use the same heuristic when a "zonk" is revealed behind one of the doors, leading them to conclude that there is a 50/50 probability that the prize is behind one of them. This heuristic is difficult to abandon when the nature of the problem changed, as the problem solution shifts from an unconditional probability to a less intuitive conditional probability. Most people refuse to accept this shift.

Perhaps, more interestingly, most subjects refuse to accept the validity of mathematical proofs offered to demonstrate the wisdom of switching doors. Furthermore, most subjects continue to refuse to switch doors after being permitted to watch repeated trials of this experiment where the third door leads to the valuable prize with a frequency of approximately 2/3. Hence, subjects seem to either never learn from their errors or learn very slowly.

Kluger and Wyatt [2004] conducted experiments to determine how a market might behave in such a scenario. "Investors" participated in repeated trials, were offered opportunities to select doors and then compete to pay to either retain or switch their selections. If investors were rational, market prices to switch should be twice the levels of prices to retain original selections. Kluger and Wyatt found that when all investors mis-priced the selections, prices of original selections remained roughly comparable to prices to switch. However, when as few as two "rational investors" who correctly estimated the probabilities were included in the trials, prices to switch were roughly double the prices to retain original selections. Hence, it seemed that competition among only two rational investors out of many were necessary for market prices to reflect rational probabilities.

Similarly, traders all have good reason to question their abilities to beat the market. First, at least 50% of trader are likely to be "below average," even without transactions costs. Transactions costs worsen traders' abilities to outperform random "buy-and-hold" strategies. The market efficiency hypotheses provide ample rationale to avoid the attempt to "out trade" the market. Statistical evidence demonstrating the inability to outperform the market is overwhelming.

Downright Dumb: Ticker Symbol Confusion and Spam

The Monte Hall example result is quite counterintuitive and has caused confusion even among trained mathematicians. However, investors are susceptible to even more basic errors. For example, Rashes [2001] documents numerous cases of strong correlations between stocks with similar ticker symbols. For example, shares of stock for Massmutual Corporate Investors (ticker: MCI), a NYSE listed fund that did not hold shares of any major telecommunications companies. Its shares were strongly correlated with those of MCI Communications (ticker: MCIC), realizing particularly high volume and price during the period of merger discussions and activity involving the telecommunications firm. Massmutual's returns were far more correlated with MCI's than AT&T or any of the other telecommunications firms were. In fact, there is evidence that investors bought shares of Massmutual and held them for long periods of time, believing that they had invested in MCI. Similarly, the most volatile trading day for the Castle Convertible Fund was April 15, 1997, after an article appeared in the Financial Times about investments in fraudulent companies by the Czech Value Fund (abbreviated as CVF in the article). Castle

(ticker: CVF) shares In a 22 minute span, the stock price dropped from 24.75 to 16.75 before closing the day's session at 23. On June 24, 1998, an AT&T bid for shares of Tele-Communications Inc. led to a 4.3% increase in the price of Transcontinental Reality Investors Inc. (ticker: TCI). In fact, the highest trading volume Transcontinental Reality shares had ever experienced to that date was on October 13, 1993, when when Bell Atlantic announced its intent to purchase Tele-Communications.

It has been estimated that as much as 65% of e-mail traffic is unsolicited (spam), and that 15% of this spam is touting shares of stock. Such spam operations have been linked to pump and dump operations, where operators tout shares of stock and them sell them. A working paper by Frieder and Zittrain [2007] claims that stock volume for touted shares increases dramatically after spam is delivered. Frieder and Zittrain describe one scenario:

> *In a well-known case brought by the U.S. Securities and Exchange Commission, stock touter Jonathan Lebed routinely purchased stock accounting for anywhere from 17% to 46% of the stock's market volume for a day, and sent spammed e-mail touts on the same day. He then lodged limit orders to sell for the next day's trading session, anticipating a rise in the stock price after the general public received his touts and some acted on them. (Lebed's case and subsequent settlement with the S.E.C. focused on his failure to disclose his own financial interest in the securities he touted; as discussed below, stock touts today often include such disclosures (In Re Lebed (2000)).*

Frieder and Zittrain found that on days prior to touting, and on days touting takes place, returns are positive. Returns after touting are negative. Two-day returns average –5.25%, worsening further when the intensity of touting increases.

Myopia, Overreaction, Overconfidence and Successful Traders

Several studies have suggested that investors react more to the most recent information than they should, and that they are too influenced by short-term price swings than they should be. In addition, Griffin and Tversky [1992] and Sorescu and Subramanyam [2004] find that investors tend to overreact to dramatic upgrade recommendations of less experienced and less reputable analysts while they under react to less dramatic upgrade recommendations to more experienced and more reputable analysts. Furthermore, there is some empirical evidence (to be detailed later) that stocks that experience wide short-term price swings reverse those swings in the intermediate-term. This behavior suggests that investors may over-react to information. In addition, there is much evidence in the psychology and investments literature that people tend to be overconfident in their own judgments, perhaps, oddly enough, even enabling certain overconfident traders to generate higher profits than their more rational competitors under limited conditions. There is also evidence that experts tend to be more prone to overconfidence than novices and maintain reputations for their expertise. Overconfident traders also tend to be more aggressive in their trading strategies, in some instances, improving their returns.

Myopia

Consider a paper by Benartzi and Thaler [1995] that examines the widespread large differences between bond and stock returns. From 1925 to 1997, intermediate term government bond returns have averaged approximately 5.2% while stock returns have averaged

approximately 10.7%. This spread indicates reluctance on the part of investors to buy stock, even though for practically every intermediate to long-term period over the past 75 years, investors could have expected to earn more in stock markets. Benartzi and Thaler argue that even long-term investors have a myopic outlook, causing them to make every effort to avoid short-term losses and risks. For example, their experiments conducted on university employees indicated that when shown only the 30-year returns on stocks and bonds, employees preferred to hold more stock in their pension accounts. Thus, when employees see how much money will be available in their retirement accounts in 30 years, they prefer the higher returns associated with stock. However, when shown additional information reflecting the entire year-by-year return path over the 30-year period, employees preferred less stock in their accounts, even though they still would have more money at the end of the period with stock investment. Thus, investors with a long-run orientation to investment still maintain a myopic aversion to risk because they care not only about how much money they will have available when they retire, but their gains and losses en route to their retirements.

Jeremy Siegel, in his book titled *Stocks for the Long Run* [1994] lends support for this myopia argument, arguing that "It is widely known that stock returns on average, exceed bond returns in the long run. But it is little known that in the long run, the risks in stocks are less than those found in bonds or even bills!" While this may overstate the risk/return point, it does seem that most investors overemphasize short-term risk at the expense of long-term returns.

Numerous experiments reported in the psychology literature have indicated that individuals in their decision-making tend to over emphasize recent information and trends and under emphasize prior information. For example, Shiller found that at the peak of the Japanese market, 14% of Japanese investors expected a crash. However, just after the market did crash, 32% expected another crash. Even professional analysts tend to overreact to new information. Excessive dependence on recent information may lead the market to overreact to new information, and may even explain the so-called price to earnings ratio anomaly (discussed later). In an important paper, Shiller [1981] examines empirical data and argues that the volatility in stock markets cannot be explained by the volatility of cash flows (dividends) associated with stocks, suggesting that investors may overreact to risk. Prices are extremely sensitive to potential future earnings anticipations, in fact, too sensitive.

Overconfidence

How many investors believe that they are better than average traders? How many drivers think that they are better than average?[4] How many people think that they are dumb (less intelligent than average)? Half? Certainly, no one begins trading stocks thinking that he will perform worse than the market or other traders.[5] But, how do typical investors actually fare? And how do they fare relative to professionals?

First, several studies show that trading activity increases when traders are overconfident. Overconfident traders tend to be more aggressive in their trading strategies. Overconfident

[4] Svenson [1981] found in his survey of 22 year-old drivers that 82% considered themselves to be among the 30% safest.

[5] For example, Ito [1990] finds in surveys of foreign exchange traders that most are more optimistic about how rate changes will affect them than they are about how rate changes will affect their competitors.

traders underreact to the information content of trades by rational traders, causing positive serial correlation in returns. Odean [1998a, 1998b] and Barber and Odean [2002], in studies of trading in 10,000 and over 60,000 discount-brokerage accounts from 1987 to 1993 and from 1991-1996, found that trading by investors reduced their levels of wealth below what they would have realized with buy-and-hold strategies. For example, they found that stocks these investors sold beat the market while those they bought did worse. By one year after the trades, the average investor ended up over 9% worse off than if had he done nothing. Amateur traders clearly underperformed the market and the most active traders experienced the worst performance. While commissions certainly hurt these traders, the data suggested that bid-ask spreads hurt them even more. However, their trading activity would have reduced their wealth levels even if trading costs had been zero. Interestingly, investors who traded the least actually beat market indices.

In another line of inquiry, Lichtenstein, Fischhoff and Phillips [1982] argue that people tend to be overconfident in their own judgments. Griffin and Tversky [1992] argue that experts tend to be more prone to overconfidence than novices and maintain reputations for their expertise. There is an upside to overconfidence. Taylor and Brown [1988] argue that overconfidence leads "to higher motivation, greater persistence, more effective performance and ultimately more success." Perhaps, according to Kyle and Wang [1997], more aggressive trading behavior of overconfident professional traders them to generate higher profits than their more rational competitors.

Numerous studies have suggested that men are more prone to overconfidence than women, particularly in male-dominated realms such as finance. Using account data from over 35,000 accounts from a discount brokerage firm, Barber and Odean (2001) find that men trade 45% more frequently than women, reducing their returns by 2.65% compared to 1.72% for women. Differences between men and women in the trading realm are so striking that one might pose the question "Do people trade for entertainment in addition to wealth creation?"

If traders, particularly aggressive individual traders lose money relative to the market, who makes money? Consider a study by Barber et al [2007] covering the entire Taiwanese stock market from 1995 to 1999. They document that individual investor trading results in consistently large losses averaging approximately 3.8%. These individual investor losses amount to 2.2% of Taiwan's GDP, almost as much as total private expenditures on clothing and footwear. These losses are attributable to aggressive trading behavior. On the other hand, institutional investors outperform the market by 1.5% (after commissions and taxes, but before other costs). Both aggressive and passive trades of institutions are profitable. Perhaps aggressive trading behavior leads to wealth transfers from amateurs to professional traders.

Over-reaction

Stocks that experience wide short-term price swings may have a tendency to reverse those swings in the intermediate-term. This behavior suggests that investors may over-react to information. As we will discuss later, DeBondt and Thaler [1985] argue that the market overreacts to information and that abnormal returns can be realized by buying losers and selling winners. Their study indicated that buying stocks which performed poorly in a prior 3-5 year period and selling those which performed well would have generated higher than normal returns in subsequent 3-5 year periods. Most significant mean reversion tendencies seem to hold for the

month of January.

Investor Moods, the Weather and Investment Returns

There is some evidence that investor moods might significantly affect market performance. For example, Kramstra, Kramer and Levi [2003] found that Seasonal Disorder, medical condition where the shorter days in fall and winter lead to depression for many people, is associated with reduced stock market returns after adjusting for a variety of other factors. Seasonally related factors can be captured by examining cyclical ties in markets with varying latitudes of markets, paying attention to variations in behavior near solstices and equinoxes. Northern and southern hemisphere returns seem six months out of phase.

Several studies have found that weather might affect market returns. For example, Hirshleifer and Shumway (2003) found that cloud cover in the city of a country's major stock exchange is negatively correlated with daily stock index returns in 18 of 26 national exchanges for the period of 1982 – 1997. Stock market performance was simply worse on cloudy days. In New York City, there was a 24.8% annualized return for all days forecast to be perfectly sunny, and an 8.7% average return occurred on cloudy days. There seems to be evidence in the psychology literature indicating that sunshine improves investor moods, and may collectively increase investor willingness to accept risk. Limpaphayom, Locke and Sarajoti (2005) obtained consistent results using wind and the traders on the Chicago Mercantile Exchange, with windy days seeming to increase bid-ask spreads.

However, despite these dramatic return differences, the evidence on the relationship between investor behavior and weather is not entirely clear. For example, Goetzmann and Zhu (2002) analyzed trading accounts of 79,995 investors from 1991 to 1996, finding that individual investors trading behavior is no different on sunny days than on cloudy days. Nevertheless, market-maker behavior was significantly affected by cloud cover in one important respect: cloudy days were associated with wider bid-ask spreads on cloudy days, suggesting that investors (or market makers) were more risk averse on these days.

Scientific evidence is clear that lunar cycles are related to tides, animal behavior and other natural phenomena. In related research drawing on inconsistent research results indicating that homicide rates, hospital admissions, and crisis incidents all peak in the days around full moons, Dichev and Janes [2001] find evidence that stock returns around new moons nearly double those around full moons. The effects arise in U.S. stock markets over 100 years and in other markets over the past 30 years. Are there good explanations for this? Should we suspect that eventually anything can proved or disproved with careful statistical analysis?

Simplifying the Decision Process

Even if investors were able to efficiently and rationally process small information sets for simple decisions, are they capable of processing larger sets of information for more complex decisions? Consider the following case illustrated by Bently MacLeod and presented by Andrew Lo in TIAA-CREF's Investment Forum:

> *[C]onsider the simple task of getting dressed in the morning: For a typical male wardrobe of 5 jackets, 10 pants, 20 ties, 10 shirts, 10 pairs of socks, 4 pairs of shoes and*

5 belts, there are two million different combinations to evaluate, and if we allow one second to evaluate each outfit, it would take about 23 days to select the "best" outfit . . . Yet we all seem to get dressed in just a few minutes - how?

In any case, the argument for assuming capital markets efficiency when developing financial models is strong. Models based on rationality tend to be simple and one can argue that rational investors generate market prices despite a large contingent of irrational investors. However, regardless of their intuitive appeal, theoretical models should not be accepted without consideration for empirical evidence. There exists much controversy within academia and in the profession regarding the extent to which models of market efficiency reflect reality. The following sections represent a sampling of this literature.

Neurofinance: Getting into the Investor's Head

While neoclassical economics has given us excellent tools to understand market behavior, behavioral finance has enabled to better understand how financial markets might behave when its participants are irrational. Behavioral finance uses methods and results from cognitive psychology to better understand financial decision-making. Neurofinance, in its infancy stages, is concerned with understanding the neurological processes in the investor's brain as he makes financial decisions. In one well-publicized paper, Shiv et al [2005] studied the relative abilities of brain-damaged study participants to make gambling decisions. This study gathered 19 subjects that had incurred damage (stable focal lesions) to parts of their brains impairing their abilities to process emotions. The subjects were asked to participate in a series of gambles along with two control groups, one that had experienced no brain damage and a second group that had experienced some other type of brain damage. Each study participant was asked to participate in a sequential series of 20 gambles, betting $1 against a 50/50 chance at either 0 or $2.50. The expected value of each gamble was $1.25, $.25 higher than its cost. The subjects experiencing damage to their emotional circuitry bet more consistently than their "normal" counterparts and earned more money. The performance differences were more pronounced after non-impaired subjects experienced losses, making them even more reluctant to take advantage of expected wealth-increasing gambles. The performance of the emotionally damaged group compared favorably to the control group of participants who had experienced no brain damage and to the second control group who had experienced unrelated types of brain damage.

A contrasting study by Naqvi, Shiv and Bechara [2006] found that subjects with similar brain damage (in the ventromedial prefrontal cortex) impairing their abilities to experience emotion seem unable to learn from mistakes in everyday life decisions, leading to repeated impairment of their well-being. Similarly, when faced with repeated losses in "rigged" gambling scenarios, subjects with impaired ability to experience emotions seemed unable to learn from negative experiences. Perhaps, in sum, this and the previous studies suggest that emotions are useful in reacting to negative experiences but can lead to irrational overreactions.

Other neurofinance studies have focused on brain imaging tools, including the EEG, PET Scans and, most importantly, fMRI. Knutson and Peterson [2005] discuss the application of fMRI technology to map Expected Utility while Kuhnen and Knutson [2005] focus directly on financial risk-taking. In one study of professional foreign exchange traders, Lo and Respin [2002] used fMRI to find that more experienced traders experienced significantly less emotional

reaction to dramatic market changes than did their less experienced counterparts. Essentially, they "wired" traders to examine their physiological reactions to changes in market conditions.[6]

Rational Investors and Price Setting

Consider an example with a minimum of two rational traders and many other irrational investors. The two rational traders competing against other can force prices up to rational levels as they compete to buy. They will force prices down to rational levels as they compete to sell. As irrational buyers buy at high prices, rational sellers will sell, competing to keep prices down to rational levels. As irrational buyers sell at low prices, rational sellers will compete to buy, competing to keep prices up to rational levels.

Observations of the behavior of individuals and a variety of experiments have indicated that apparently irrational decision-making frequently governs actions of consumers and investors, particularly in cases that involve potential losses. Nonetheless, might one expect that rational investors will outperform irrational investors in the market? Might rational investors tend to better preserve their capital, and even that of other investors (e.g., as professional money managers)? Perhaps, the market will tend to drive out (or bankrupt) irrational investors or at least, in time, reduce their impact on the market? Perhaps, the rational investors, always driving to exploit an opportunity at the expense of irrational investors, will force market prices to properly reflect information whenever a deviation occurs? That is, might rational investors through their own efforts to secure profits, dominate the market and force prices to fully and rationally reflect available information? Furthermore, people observing the actions of others may be all too eager to note apparent irrational behavior. One is usually not able to observe the actual rationale or basis for the actions of others, and hence, may not be in a strong position to determine whether the resulting behavior truly is rational.

[6] Zak [2004] provides a very readable introduction to neuroeconomics methodology and literature and Peterson [2005] provides an introduction more specific to finance literature.

D. The Consensus Opinion: Stupid Investors, Smart Markets?

Is it possible for a market comprised of irrational investors to actually, in sum, behave rationally? Is it likely that rational or educated investors play a greater role in the price-setting process than less rational or poorly-educated investors? Could poorly educated or irrational investors be driven out of the price-setting process as their wealthier investors gain more power as they accumulate more wealth at the expense of their irrational counterparts? Consider a hypothetical market where professional analysts and competing investors are attempting to secure and employ all information that would enable them to evaluate stocks more accurately. However, none of the analysts have perfect information, and cannot know with certainty what the values of stocks are. Further assume that each analyst may have some information (or method for analyzing this information) not available to other analysts. However, each analyst may be lacking some information or technique known to his competitors. Thus, information sets available to different analysts are not perfectly correlated. Given a reasonably large number of analysts, one might expect their errors to offset or cancel to some extent and that their "average" or consensus projections to outperform any given analyst's forecasts. In this scenario, the market prices generated by the large number of analysts and investors may be closer to the true security prices estimated by any individual analyst or investor. It would be very difficult for the individual investor to beat the market in this scenario.

Surowiecki [2004] described the popular TV show *Who Wants to Be a Millionaire?* to demonstrate the "wisdom of crowds" relative to individual decision-makers. In this show, a contestant was asked multiple-choice questions, which, if answered correctly, could result in winnings of as much as $1 million. The contestant had the option ("lifeline") of seeking each of three types of assistance should he require it. The contestant could request to have two of three incorrect answers eliminated from the answer set, call a friend or relative to ask for help or poll the studio audience who would vote on the correct answer. Eliminating incorrect answers should produce correct answers at least 50% of the time. Phone calls to friends or relatives produced the correct answer almost 65% percent of the time. However, the studio polls produced the correct answers 91% of the time, suggesting that the crowd wisdom did seem superior to individual opinions, even potentially expert opinions.

Numerous experiments have demonstrated that averages of classroom estimates of temperatures are more accurate than individual student estimates. Similarly, average estimates provided by surveys produce better estimates of numbers of jelly beans in jars than individual estimates. Such experiments do suggest that the crowd may compile information to produce better estimates tan individuals acting alone.

The Football Pool

Sports forecasting and betting provide excellent opportunities for testing market efficiency in that true outcomes are revealed after games are played. Consider the following table provided by Beaver [1981] to describe how football reporters may find it difficult to outperform consensus forecasts made by a group of their colleagues.[7] The *Chicago Daily News* recorded the college football predictions of its sports staff for the last weekend of November during the 1966-

[7]This example was described in Foster [1986].

68 seasons. While the results of this "study" are not derived in a particularly scientific manner, the data is reported as follows:

SOURCE: Beaver (1981, Figure 6.1: p. 162), Foster (1986, Table 9.1: p. 325)	1966	1967	1968
Total forecasters (including consensus)	15	15	16
Total forecasts made per forecaster	180	220	219
Rank of consensus forecast	1-tie	2	2
Median rank of forecasters	8	8	8.5
Rank of best forecasters			
J. Carmichael (1966)	1-tie	8	16
D. Nightingale (1966)	1-tie	11	5
A. Biondo (1967)	7	1	6
H. Duck (1968)	8	10	1

While the above table suggests that a consensus generates better football predictions than a single analyst, to what extent would this result hold in the stock market? An individual analyst might be regarded as able to generate superior forecasts if his returns consistently outperform those of the market on a risk-adjusted basis. While it is certain that a number of investors consistently outperform the market, it is likely that a much larger number claim to do so. Furthermore, in a market with millions of investors, many would consistently outperform the market even if all selected their investments randomly. Perhaps, one should be somewhat skeptical when reviewing reports of superior investment performance.

Analyst estimates

Because earnings forecasts are such an integral part of the typical analyst's stock valuation process, a number of studies have been performed to determine analysts' abilities to forecast EPS. Studies have indicated that consensus forecasts for EPS are superior to those of a randomly selected analyst (e.g., Fried and Givoly [1982]). By combining a large number of forecasts, individual analyst idiosyncratic errors will tend to offset one another. Several firms make consensus forecasts available to the public, including Lynch, Jones & Ryan's Institutional Brokers Estimate System (IBES) and Zacks Investment Research, Inc. Furthermore, as one might expect, studies suggest that EPS forecasts become more accurate as announcement dates approach (e.g., Brown and Chen [1990]). However, a number of studies have demonstrated that analysts' EPS forecasts tend to be overly optimistic, perhaps by as much as 20%. A number of hypotheses have been offered to explain this phenomenon, including interests of the underwriting divisions of investment banks. Nonetheless, there is evidence that investors account for this bias and are able to sift through a huge volume of other information (and mis-information) to price securities. The extent to which investors and the market are able to price securities appropriately represents the extent to which the market is efficient.

E. Stock Market Bubbles

Earlier in this chapter, we suggested that many or perhaps most investors display some traits of irrationality in their decision-making behavior. We further considered the possibility that markets, perhaps through some sort of consensus formation, might behave rationally despite the irrationality of its participants. However, suppose that the consensus formed by the set of irrational investors is itself irrational, causing market prices themselves to behave in an irrational manner. Perhaps, for example, investors subscribe to some sort of "greater fool than thou" perspective, each believing that value is irrelevant as long as another investor will pay more. Might this be the foundation to bubble formation? And the cessation of this irrational consensus result in the bursting of the bubble?

Financial euphoria is characterized by increased financial activity (volume) and increased security prices. Financial euphoria usually occurs at the peaks of business cycles. Typically, such euphoria results in security market prices exceeding fundamental values. Bubbles may be characterized as sustained security price levels that exceed fundamental values. One might argue that the value of a security is a function of its expected future value. This expected future value is either a function of the fundamentals of (expected future cash flow associated with) securities or anticipated market values of securities. In markets with investors holding homogeneous expectations, these values might be expected to be identical. In a sense, to recall the analogy of John Maynard Keynes, one might argue that the winner of a beauty contest should not be forecast based on an objective definition of beauty, but based on a prediction on how judges will vote. Thus, security prices may not be a function of fundamentals, but might actually be a function of the "average opinion of what the average opinion will be." In this type of environment, bubbles may be caused by market psychology, herding behavior, or even perfectly rational behavior where investors attempt to squeeze profits from their competitors playing a game roughly comparable to "chicken." The term bubble implies a potential for a violent burst or bust, where prices rapidly return to fundamental values or even below fundamental values. History is full of interesting examples of financial euphoria and subsequent collapses. The following represent a sampling.

The Dutch Tulip Bulb Craze

One of the best-known financial bubbles in history was the Dutch Tulip Bulb craze, which started in the Netherlands when tulips were imported from Turkey in 1593. The flower was desirable, but became most desirable when the tulips contracted a non-fatal virus known as mosaic, that caused striking color patterns in the blooms. The tulips, already quite popular, began to rise in price according to how their virus alterations were valued in the market. As more and more people participated in the markets for tulips and their bulbs, prices skyrocketed. Within a short period, prices were rising so fast and high that people were trading everything they owned to speculate in the tulip bulb markets. In time, first the savvy investors and then the less sophisticated investors realized that tulip bulbs were vastly overpriced and the market collapsed. Prices dropped so sharply and so quickly causing pandemonium not only in the markets for tulip bulbs, but in the Dutch economy as a whole, causing a major depression. The government attempted mitigate the crash by honoring tulip contracts at 10% of their face values, but this seemed too little and too late.

The South Sea Bubble

The joint-stock company became viewed by the English in the latter part of the seventeenth century as a more convenient ownership device than traditional ownership. The joint stock company, collectively owned by many shareholders who were able to easily transfer their ownership, enabled its owners to assign management tasks to professional managers. Such companies were treated as legal entities unto themselves and paid taxes, just as individual taxpayers. This form of joint stock ownership facilitated financing of many new ventures including industrial production, explorations, and, perhaps most importantly, a variety of projects in far away lands such as America, India and the Far East.

During the early seventeenth century, the English government was burdened with substantial debts to pay for its wars with the French. In an effort to reduce its debt, the government offered its bondholders (actually annuitants) the opportunity to convert bonds into the stock of a newly formed firm, the South Sea Company. This company would hold a government monopoly on trade in the South Seas, the region comprising the Pacific Islands, Spanish America and the Caribbean. In an effort to make the stock more attractive to investors, the company's managers were permitted by the government to stir speculative interest in the firm and manipulate its price. At the same time, managers were permitted to create additional shares which they would keep for themselves. The government benefitted from this activity because its debt was convertible into shares of the firm. Certain influential government officials received "free" shares. With substantial government backing of deals, the stock price jumped from £129 on February 2, 1720 to £1000 by June. More than half of the government's annuity debt was wiped out.

The South Sea Company frenzy fueled frenzies throughout stock markets. New companies were being created and financed by the public through stock offerings by the dozens. Many of these companies were clearly of dubious value from the start including the firms created:[8]

For trading in hair
For a wheel for perpetual motion
For the transmutation of quicksilver into a malleable fine metal
To make salt water fresh
For importing a number of jackasses from Spain
For building of ships against pirates
For a company for carrying on an undertaking of great advantage, but nobody to know what it is

The last company promised a return of 100% per year, collected £2,000 within five hours of its initial offering at which time the promoter disappeared.

Sir Isaac Newton, who stated in the spring of 1720 "I can calculate the motions of heavenly bodies but not the madness of people," bought shares for approximately £3,500, which he sold on April 20 for a 100% profit. He later invested a much larger amount near the peak of the market, causing him to eventually lose £20,000.

[8] From a four page list in MacCay [1841]

In August, South Sea insiders were selling out. By November, its price had dropped to £135, dragging the rest of the market with it. The market, on average, lost 84% of its peak value. All told, the South Sea Bubble and Crash took only eight months to run its cycle. The Bubble Act was passed in 1720 (and in effect until 1856) forbidding the formation of new stock companies without the expressed approval of Parliament. An intense effort to bring to justice those responsible for this collapse ensued. This effort was largely unsuccessful.

The Original Ponzi Scam

The Ponzi scheme is named for an Italian immigrant Carlos Ponzi, who in 1919, discovered an arbitrage opportunity for which he required financing. He had spent most of his working life as a dishwasher, waiter, clerk, etc., but learned that he could trade postal coupons obtained in Spain for one cent for 6 cents of postal coupons in the United States. Hence, he proceeded to solicit investors to participate in this opportunity, promising returns of approximately 50% in 45 days. The scheme seemed simple enough and thousands of investors participated. Several government agencies examined Ponzi's operations, but found no illegal activity. Over several months, thousands of investors demanded their money back. Ponzi complied with each demand, enhancing his credibility. Essentially, each investor was paid from proceeds realized from the sale of securities from other investors and not enough envestors demanded money back to render Ponzi insolvent. Payment from new investor proceeds was necessary because the red tape and various obstacles and expenses made the original arbitrage scheme unprofitable. When a Boston newspaper questioned the legitimacy of Ponzi's operations, state regulators investigated Ponzi's books and prohibited him from selling additional securities. Ponzi was still able to meet demands for cash, further enhancing his credibility. He invested company proceeds into a new bank, The Charles Ponzi Company, which brought in even more money. In time, bank auditors declared the bank to be bankrupt and it was revealed that Ponzi had served time in prison for an earlier fraud. This caused his operations to collapse and created widespread panic and even caused a number of other banks to fail. Ponzi was jailed for mail fraud and spent the remainder of his life in and out of prison for various types of fraud before dying in Brazil with enough money to be buried.

The Roaring 20's and the Great Crash

The aftermath of World War I produced first a brief business boom followed by a recession from which the economy had largely recovered by 1922. The five-year period preceding the crash of 1929 was one of the strongest bull markets in U.S. history. It was fueled by a doubling of industrial production, improved transportation and communication systems, higher standards of living, a general feeling of economic prosperity and substantial stock market speculation and abuses. Stock market volume more than doubled from 1926 to 1929. Money flowed into the U.S. from Britain and elsewhere, attracted by the ever-increasing stock prices.

The DJIA closed 1928 with a 28% gain, beginning the year at 245. By September 3, 1929, the index peaked at 452. A number of officials and investors believed that the market was in danger of crashing. The Fed generally acted timidly, fearing that its actions would cause a crash. It urged banks to curtail lending to enable clients to buy stock on margin. Banks refused. Roger Babson warned of a crash, but was ignored just as he had been when his previous warnings failed to materialize. William Crapo Durant (market manipulator and founder of

General Motors), Michael C. Bouvier and John D. Rockefeller Jr. were all liquidating their holdings the summer before the crash. Joseph Kennedy sold his stock prior to the crash. When asked why he had converted his shares to cash, Kennedy replied that when shoeshine boys were passing on stock market tips and calling market turns, it was time to get out.[9] Kennedy proceeded to make even more money during the crash, selling short as the bottom fell out of the market.

During 1929, investors began to question whether the anticipated corporate profits would ever materialize. It became apparent that too much of the newly created wealth of the 1920s was concentrated in the hands of too few people. This caused consumer spending to fail to maintain pace with increasing productivity. Factory wages rose at less than half the level of factory productivity. The resulting increased profits were fed into speculation and the market frenzy. Passage of the Smoot-Hawley Act increased tariffs on imports; other countries responded by raising tariffs of U.S. exports. These actions caused a trade war, substantially curtailing markets for U.S. exports and restricting demand for U.S. production.

A variety of stock market scams were carried out, manipulating market prices and generating illusory profits. Pools, wash sales and other abuses (all to be described later) were commonplace. One scheme generating huge profits was the creation of investment trusts to leverage investment gains. While such leverage in and of itself need not be fraudulent, many trusts were pyramid schemes, involving substantial cross-ownership. Much of their value gains was pure illusion.

Although the market crashed by over 25% on Black Thursday, October 24, 1929, it lost only 17% for the year January to December. However, further market losses ensued in 1930 and 1931. The market lost 87% of its peak value over a four-year period, with the DJIA bottoming out at 58 in July 1932. The United States economy was in a depression from which it could not self-correct.

Yuppies, Rocket Scientists, and the Crash of 1987

The 1980s (the “Me Decade”) began with an economic recession, declining oil prices, a sharp turn to the right in the political environment, a desire to deregulate and to reduce taxes. By the mid-1980s, the dollar was strong, the economy was booming and Wall Street was enjoying its greatest period of prosperity since the 1920s. Yuppies (Young Urban Professionals - a take-off on 1960s Yippies) had become the "masters of the universe." MBAs in their twenties and thirties were drawing six and seven figure salaries and bonuses in major Wall Street firms. This was the decade of unprecedented merger activity and financial innovation.

No one seems certain what actually caused the crash of October 19, 1987 (Bloody Monday). Nonetheless, in one day, the DJIA had lost 508 points, 22.6% of its opening value. Many explanations for this crash have been proposed, yet none seem adequate. Over the years, the U.S. had accumulated hundreds of billions of dollars in trade and government budget deficits.

[9]Similarly, Philip Coggan in a 1996 *Financial Times* article commented “Collectors of stock market omens need look no further. The cover of April's *Playboy* magazine highlights an article on picking successful mutual funds. When Joe Sixpack stops looking at naked ladies long enough to phone his broker, that is probably a sign that the top of the bull market is near.”

A hurricane slammed into Briton on Friday October 16th, causing hundreds of millions of pounds in damage. On this same day, an Iranian missile hit a U.S. tanker in the Persian Gulf. Japanese investors had just sold hundreds of millions of dollars in treasury bonds. The West German government had just announced an increase in interest rates. Treasury Secretary James Baker announced annoyance at this action by the West Germans. U.S. investors worried that a retaliatory response by the U.S. might result in interest rate increases. Program traders and portfolio insurance were both blamed for exacerbating the crash. Nevertheless, these events seemed no more significant than typical events occurring over typical weeks.

Some observers have argued that the October 1987 crash was not based on information at all; it was merely the result of trading. Close examinations of larger price drops over the past 80 years suggest that many seem not to be tied to relevant information. Perhaps many crashes are simply the result of traders and the noise that they create.

Practically every stock market in the world was affected by the October 19 crisis - except for that of Japan. Its market waited until 1990 to collapse, falling from a December 1989 high of 38,915 (Nikkei Index) to 14,309 by August 1992. The Nikkei Index was as low as 14,833 in June, 2006, still not recovered from its collapse in 1990.

One of the more enjoyable effects of the October 1987 crash for those not employed in the finance industry was the round of layoffs of over 40,000 Wall Streeters as of 1990. Jokes about only pigeons being able to make deposits on BMWs and the downwardly mobile were all the fashion. Yuppies earning six and seven figure incomes were suffering the same fates as workers in previous years. Many newly minted MBAs were lucky to find work managing shoe stores. Nonetheless, by the mid-1990s, young urban professionals again became masters of the universe, and continue to thrive fifteen years later..

The Asia Tigers

From one perspective, the rapid growth of East Asian economies is due to the Plaza Accord of 1985 in which the world's wealthier economies agreed to drive down the dollar against other major currencies. Since the values of most East Asian currencies were pegged against the dollar, their values dropped as well, precipitating a surge in East Asian exports. In the early 1990s, exports rose at an annual rate of 18%. Forecasts called for continued high rates of growth. Revenue from exports led to cheap capital and massive investment in the region, particularly in the real estate industries. Over-borrowing led to real estate speculation and over-expansion of industrial capacity. However, in 1995, the dollar began to rise against other world currencies, causing an increase in East Asian currency values. This increase led to a decline in the rate of export growth in 1996.

The first of the "Asia Tigers" to fall was Thailand. Thailand had borrowed short-term heavily, increasing its debt from $29 billion in 1993 to $69 billion by 1997. The baht weakened as speculators sold it; the Thai government was unable to adequately defend it. Private sector lending to Thailand all but ceased and its central bank was forced to seek assistance from the International Monetary Fund (IMF). It was soon apparent that other countries in the region shared the same weaknesses; the next round of falling tigers included Indonesia, the Philippines, Malasia and South Korea. South Korean firms had overused credit (particularly short-term

credit) due to government encouragement for bank lending to favored industrial sectors, chaebol arrangements and cheap money from overseas.

Crashing East Asian economies were exacerbated by political instability, inadequate government regulation, particularly with respect to banks, overuse of debt, questionable accounting practices, corruption and other calamities. For example, political upheaval in Indonesia led to the overthrow of the Suharto regime and massive 1997 forest fires devastated huge tracts of land and even caused environmental damage to other countries in the region. Political and bureaucratic corruption are rampant in Indonesia while its regulatory system is insufficiently developed to maintain a viable financial system.

Despite the many economic problems long inherent in this region, many economic analysts believe that markets have overreacted to the Asia crisis. They feel that regional currencies are now undervalued against the dollar due to massive selling by borrowers attempting to repay short-term loans. Nonetheless, the full impact to the region and to the world of this crisis is yet to be determined.

The Dot.Com Bubble of the Late 1990's

The Internet was created in the late 1960s by U.S. military offices, began to grow in academic circles and by 1995, had an estimated 18 million users. Over the next several years, Internet use increased by leaps and bounds and had seemingly unlimited commercial potential. Many companies were formed to tap this potential. In 1999 alone, there were over 400 Internet stock IPOs, with approximately 25% doubling in price on their first day of trading. Many of these companies had never earned a profit and many never would. Many of the IPOs had been hyped by analysts working for their underwriters, leading to a major Wall Street scandal. As the economy fell into a recession, and as investors began to recognize that they had overestimated the potential of the Internet (at least in the short term), prices of Internet, technology and communications stock quickly plunged.

As Internet industry stocks were hyped and bid to extraordinary levels, defined benefit plans were yielding to defined contribution plans such as 401k's, 403b's and IRAs. Employees were investing ever-increasing sums into stock markets, while mutual fund stock funds almost tripled in size over the 1990s. Declining brokerage commissions and improved trading technology had an enormous impact in individual investor trading activity. These factors, and more facilitated a twenty-year S&P500 gain of 1239% starting in January 1980. Over the same period, dividends on the shares underlying the index rose by only 188%, while their earnings rose by 254%. Between August 2000 and February 2003 the S&P dropped by 44%. Why were price gains so out of line with dividends and earnings? Did the period 1980-2000, particularly the last five years, reflect a stock market bubble? Perhaps prices were particularly low or dividends and earnings particularly high in 1980?

Exercises

1. If price changes reflect new information, why should returns fluctuate randomly?

2. A car with a replacement value of $20,000 can be insured against a total loss with an insurance policy sold for a premium of $1,200. The insurance company selling the policy and the consumer purchasing the policy agree that there is a 5% probability that the car will be destroyed.
   a. What is the actuarial (fair or expected) value of the policy?
   b. If the insurance maintains a large, well-diversified portfolio of such policies, what is its expected profit from the sale of this policy?
   c. What is the expected profit (or gain or loss) to the consumer from the purchase of this policy?
   d. Under what circumstances is the sale of this policy a rational transaction for the insurance company?
   e. Under what circumstances is the purchase of this policy a rational transaction for the consumer?

3. Suppose that you were to perform an experiment on subjects to determine whether they prefer to have coffee mugs or money. You plan to use a large representative sampling of individuals and endow half of the participants in your experiment with coffee mugs and then ask those to whom mugs were given what would be the lowest price at which they would sell. Those subjects who were not given mugs were asked how much they would pay for a mug.
   a. If participants are rational and consistent in their preferences, how should purchase prices differ from selling prices?
   b. Assume that the endowment effect described by Kahneman and Tversky is true for individuals. How should purchase prices differ from selling prices?
   c. What would be the relevance of this type of experiment to stock markets?

4. For each of the following three scenarios, would you rather:

   i. Receive $100 in one month or $100 in two months (most people prefer the former)?
   ii. Be given an excellent meal at a nice restaurant in one month or in two months (most people prefer the former)?
   iii. Be given a mediocre meal at a mediocre restaurant in one month and then an excellent meal at a nice restaurant in two months or an excellent meal at a nice restaurant in one month followed by mediocre meal at a mediocre restaurant in two months (most people prefer the former)?

Assume that you respond as do most people. Explain any inconsistency in your preferences.

5. Churches, schools and other non-profit institutions have held jelly bean counting contests where contestants compete for a prize by estimating the number of jelly beans in a large jar. There is evidence suggesting that averages of contestant estimates tend to be superior to specific individual estimates. Why might this be true?

Solutions

1. New information arrives randomly; otherwise it is not news. Thus, price reactions to news will be random.

2.a. Based on expected value, the acturial value of this policy is .05 · $20,000 = $1,000.
b. $1,200 – 1,000 = $200
c. $1,000 – 1,200 = -$200; $200 expected loss to the consumer
d. The sale is a rational transaction if the insurance company intends to increase its wealth (more is preferred to less)
e. The purchase is a rational transaction to the consumer if she is sufficiently risk-averse.

3.a. There should be no statistically significant difference
b. Selling prices will exceed purchase prices. Kahneman and Tversky actually performed this experiment and found that the median selling price was $5.79 and the median purchase price was $2.25, a ratio of more than two. On the possibility that this result might have been due to "wealth effects"—subjects given mugs were simply wealthier than those not given mugs, and this might drive the price differences. But the experiment was repeated where selling prices of one group were compared to the "choosing" prices of the other. In this scenario, subjects selected from listings of money amounts whether they would prefer to have a mug or money. Choosers are in precisely the same wealth position as sellers—they choose between a mug and money. The only difference is that sellers are "giving up" a mug they "own," whereas choosers are merely giving up the right to have a mug. The results were consistent. The median choosing price was half the median selling price ($3.50 versus $7.00). Similar experiments have been performed in many markets with consistent results.
c. Selling prices are likely to exceed buying prices by larger amounts. Investors will be more reluctant to sell stock that they already own and would be reluctant to purchase shares.

4. Option sets i and ii establish that people are impatient and associate a time value with money and good meals. However, this impatience and positive time value is inconsistent with the preference revealed in decision set iii. Apparently, in this scenario, people look forward to improved meals, as though they would give up time value to see an upward trend. This experiment was conducted by Lowenstein and Prelec [1993].

5. Each contestant has his own method for estimating the number of jelly beans, based on his abilities, experiences, visual and quantitative skills, etc. Each contestant, who possess each of these and other attributes to at least a degree, incorporates all of these attributes into his best estimate. Since each contestant makes every effort to incorporate all of these attributes into the estimation process, there will be at least some systematic and correlated individual strengths in the estimation process of the population or consensus. However, each contestant also incorporates his weaknesses and biases in the estimation process, despite his best efforts not to. If these weaknesses in the estimation process are uncorrelated, then consensus estimates will be unbiased.

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