Fooled By Randomness

Six

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SKEWNESS AND ASYMMETRY

We introduce the concept of skewness: Why the terms “bull” and “bear” have limited meaning outside of zoology. A vicious child wrecks the structure of randomness. An introduction to the problem of epistemic opacity. The penultimate step before the problem of induction.

THE MEDIAN IS NOT THE MESSAGE

The essayist and scientist Steven Jay Gould (who, for a while, was my role model), was once diagnosed when he was in his forties with a deadly form of cancer of the lining of the stomach. The first piece of information he received about his odds of making it was that the median survival for the ailment is approximately eight months; information he felt akin to Isaiah’s injunction to King Hezekiah to put his house in order in preparation for death.

Now, a medical diagnosis, particularly one of such severity, can motivate people to do intensive research, particularly those prolific writers like Gould who needed more time with us to complete a few book projects. The further research by Gould uncovered a very different story from the information he had initially been given; mainly that the expected (i.e., average) survival was considerably higher than eight months. It came to his notice that expected and median do not mean the same thing at all. Median means roughly that 50% of the people die before eight months and 50% survive longer than eight months. But those who survive would live considerably longer, generally going about life just like a regular person and fulfilling the average 73.4 or so years predicted by insurance mortality tables.

There is asymmetry. Those who die do so very early in the game, while those who live go on living very long. Whenever there is asymmetry in outcomes, the average survival has nothing to do with the median survival. This prompted Gould, who thus undderstood the hard way the concept of skewness, to write his heartfelt piece “The Median Is Not the Message.” His point is that the concept of median used in medical research does not characterize a probability distribution.

I will simplify Gould’s point by introducing the concept of mean (also called average or expectation) as follows, by using a less morbid example, that of gambling. I will give an example of both asymmetric odds and asymmetric outcomes to explain the point. Asymmetric odds means that probabilities are not 50% for each event, but that the probability on one side is higher than the probability on the other. Asymmetric outcomes mean that the payoffs are not equal.

Assume I engage in a gambling strategy that has 999 chances in 1,000 of making $1 (event A) and 1 chance in 1,000 of losing $10,000 (event B), as in Table 6.1. My expectation is a loss of close to $9 (obtained by multiplying the probabilities by the corresponding outcomes). The frequency or probability of the loss, in and by itself, is totally irrelevant; it needs to be judged in connection with the magnitude of the outcome. Here A is far more likely than B. Odds are that we would make money by betting for event A, but it is not a good idea to do so.

Table 6.1 Event	Probability	Outcome	Expectation
A	999/1000	$1	$.999
B	1/1000	-$10,000	-$10
	Total		-$9.001

This point is rather common and simple; it is understood by anyone making a simple bet. Yet I had to struggle all my life with people in the financial markets who do not seem to internalize it. I am not talking of novices; I am talking of people with advanced degrees (albeit MBAs) who cannot come to grips with the difference.

How could people miss such a point? Why do they confuse probability and expectation, that is, probability and probability times the payoff? Mainly because much of people's schooling comes from examples in symmetric environments, like a coin toss, where such a difference does not matter. In fact, the so-called bell curve that seems to have found universal use in society is entirely symmetric. More on that later.

BULL AND BEAR ZOOLOGY

The general press floods us with concepts like bullish and bearish which refer to the effect of higher (bullish) or lower (bearish) prices in the financial markets. But also we hear people saying "I am bullish on Johnny" or "I am bearish on that guy Nassim in the back who seems incomprehensible to me," to denote the belief in the likelihood of someone's rise in life. I have to say that bullish or bearish are often hollow words with no application in a world of randomness—particularly if such a world, like ours, presents asymmetric outcomes.

When I was in the employment of the New York office of a large investment house, I was subjected on occasions to the harrying weekly "discussion meeting," which gathered most professionals of the New York trading room. I do not conceal that I was not fond of such gatherings, and not only because they cut into my gym time. While the meetings included traders, that is, people who are judged on their numerical performance, it was mostly a forum for salespeople (people capable of charming customers), and the category of entertainers called Wall Street "economists" or "strategists," who make pronouncements on the fate of the markets, but do not engage in any form of risk taking, thus having their success dependent on rhetoric rather than actually testable facts. During the discussion, people were supposed to present their opinions on the state of the world. To me, the meeting was pure intellectual pollution. Everyone had a story, a theory, and insights that they wanted others to share. I resent the person who, without having done much homework in libraries, thinks that he is onto something rather original and insightful on a given subject matter (and I respect people with scientific minds, like my friend Stan Jonas, who feel compelled to spend their nights reading wholesale on a subject matter, trying to figure out what was done on the subject by others before emitting an opinion—would the reader listen to the opinion of a doctor who does not read medical papers?).

I have to confess that my optimal strategy (to soothe my boredom and allergy to confident platitudes) was to speak as much as I could, while totally avoiding listening to other people's replies by trying to solve equations in my head. Speaking too much would help me clarify my mind, and, with a little bit of luck, I would not be "invited" back (that is, forced to attend) the following week.

I was once asked in one of those meetings to express my views on the stock market. I stated, not without a modicum of pomp, that I believed that the market would go slightly up over the next week with a high probability. How high? "About 70%." Clearly, that was a very strong opinion. But then someone interjected,"But, Nassim, you just boasted being short a very large quantity of SP500 futures, making a bet that the market would go down. What made you change your mind?" "I did not change my mind! I have a lot of faith in my bet! [Audience laughing.] As a matter of fact I now feel like selling even more!"The other employees in the room seemed utterly confused. "Are you bullish or are you bearish?" I was asked by the strategist. I replied that I could not understand the words bullish and bearish outside of their purely zoological consideration. Just as with events A and B in the preceding example, my opinion was that the market was more likely to go up ("I would be bullish"), but that it was preferable to short it ("I would be bearish"), because, in the event of its going down, it could go down a lot. Suddenly, the few traders in the room understood my opinion and started voicing similar opinions. And I was not

forced to come back to the following discussion.

Let us assume that the reader shared my opinion, that the market over the next week had a 70% probability of going up and 30% probability of going down. However, let us say that it would go up by 1% on average, while it could go down by an average of 10%. What would the reader do? Is the reader bullish or bearish?

Table 6.2 Event	Probability	Outcome	Expectation
Market goes up	70%	Up 1%	0.7 Market goes down
30%	Down 10%	-3.00	
	Total	-2.3	

Accordingly, bullish or bearish are terms used by people who do not engage in practicing uncertainty, like the television commentators, or those who have no experience in handling risk. Alas, investors and businesses are not paid in probabilities; they are paid in dollars. Accordingly, it is not how likely an event is to happen that matters, it is how much is made when it happens that should be the consideration. How frequent the profit is irrelevant; it is the magnitude of the outcome that counts. It is a pure accounting fact that, aside from the commentators, very few people take home a check linked to how often they are right or wrong. What they get is a profit or loss. As to the commentators, their success is linked to how often they are right or wrong. This category includes the “chief strategists” of major investment banks the public can see on TV, who are nothing better than entertainers. They are famous, seem reasoned in their speech, plow you with numbers, but, functionally, they are there to entertain—for their predictions to have any validity they would need a statistical testing framework. Their frame is not the result of some elaborate test but rather the result of their presentation skills.

An Arrogant Twenty-nine-year-old Son

Outside of the need for entertainment in these shallow meetings I have resisted voicing a “market call” as a trader, which caused some personal strain with some of my friends and relatives. One day a friend of my father—of the rich and confident variety—called me during his New York visit (to set the elements of pecking order straight, he hinted right away during the call that he came by Concorde, with some derogatory comment on the comfort of such method of transportation). He wanted to pick my brain on the state of a collection of financial markets. I truly had no opinion, nor had made the effort to formulate any, nor was I remotely interested in markets. The gentleman kept plowing me with questions on the state of economies, on the European central banks; these were precise questions no doubt aiming to compare my opinion to that of some other “expert” handling his account at one of the large New York investment firms. I neither concealed that I had no clue, nor did I seem sorry about it. I was not interested in markets (“yes, I am a trader”) and did not make predictions, period. I went on to explain to him some of my ideas on the structure of randomness and the verifiability of market calls but he wanted a more precise statement of what the European bond markets would do by the Christmas season.

He came away under the impression that I was pulling his leg; it almost damaged the relationship between my father and his rich and confident friend. For the gentleman called him with the following grievance: “When I ask a lawyer a legal question, he answers me with courtesy and precision. When I ask a doctor a medical question, he gives me his opinion. No specialist ever gives me disrespect. Your insolent and conceited twenty-nine-year-old son is playing prima donna and refuses to answer me about the direction of the market!”

Rare Events

The best description of my lifelong business in the market is “skewed bets,” that is, I try to benefit from rare events, events that do not tend to repeat themselves frequently, but, accordingly, present a large

payoff when they occur. I try to make money infrequently, as infrequently as possible, simply because I believe that rare events are not fairly valued, and that the rarer the event, the more undervalued it will be in price. In addition to my own empiricism, I think that the counterintuitive aspect of the trade (and the fact that our emotional wiring does not accommodate it) gives me some form of advantage.

Why are these events poorly valued? Because of a psychological bias; people who surrounded me in my career were too focused on memorizing section 2 of The Wall Street Journal during their train ride to reflect properly on the attributes of random events. Or perhaps they watched too many gurus on television. Or perhaps they spent too much time upgrading their PalmPilot. Even some experienced trading veterans do not seem to get the point that frequencies do not matter. Jim Rogers, a “legendary” investor, made the following statement:

I don’t buy options. Buying options is another way to go to the poorhouse. Someone did a study for the SEC and discovered that 90 percent of all options expire as losses. Well, I figured out that if 90 percent of all long option positions lost money, that meant that 90 percent of all short option positions make money. If I want to use options to be bearish, I sell calls.

Visibly, the statistic that 90% of all option positions lost money is meaningless, (i.e., the frequency) if we do not take into account how much money is made on average during the remaining 10%. If we make 50 times our bet on average when the option is in the money, then I can safely make the statement that buying options is another way to go to the palazzo rather than the poorhouse. Mr. Jim Rogers seems to have gone very far in life for someone who does not distinguish between probability and expectation (strangely, he was the partner of George Soros, a complex man who thrived on rare events—more on him later).

One such rare event is the stock market crash of 1987, which made me as a trader and allowed me the luxury of becoming involved in all manner of scholarship. Nero of the smaller house in Chapter 1 aims to get out of harm’s way by avoiding exposure to rare events—a mostly defensive approach. I am far more aggressive than Nero and go one step further; I have organized my career and business in such a way as to be able to benefit from them. In other words, I aim at profiting from the rare event, with my asymmetric bets.

Symmetry and Science

In most disciplines, such asymmetry does not matter. In an academic pass/fail environment, where the cumulative grade does not matter, only frequency matters. Outside of that it is the magnitude that counts. Unfortunately, the techniques used in economics are often imported from other areas—financial economics is still a young discipline (it is certainly not yet a “science”). People in most fields outside of it do not have problems eliminating extreme values from their sample, when the difference in payoff between different outcomes is not significant, which is generally the case in education and medicine. A professor who computes the average of his students’ grades removes the highest and lowest observations, which he would call outliers, and takes the average of the remaining ones, without this being an unsound practice. A casual weather forecaster does the same with extreme temperatures—an unusual occurrence might be deemed to skew the overall result (though we will see that this may turn out to be a mistake when it comes to forecasting future properties of the ice cap). So people in finance borrow the technique and ignore infrequent events, not noticing that the effect of a rare event can bankrupt a company.

Many scientists in the physical world are also subject to such foolishness, misreading statistics. One flagrant example is in the global-warming debate. Many scientists failed to notice it in its early stages as they removed from their sample the spikes in temperature, under the belief that these were not likely to recur. It may be a good idea to take out the extremes when computing the average temperatures for vacation scheduling. But it does not work when we study the physical properties of the

weather—particularly when one cares about a cumulative effect. These scientists initially ignored the fact that these spikes, although rare, had the effect of adding disproportionately to the cumulative melting of the ice cap. Just as in finance, an event, although rare, that brings large consequences cannot just be ignored.

ALMOST EVERYBODY IS ABOVE AVERAGE

Jim Rogers is not the only person committing such traditional fallacy of mistaking mean and median. In all fairness to him, some people who think for a living, such as the star philosopher Robert Nozik, have committed versions of the same mistake (Nozik, besides, was an admirable and incisive thinker; before his premature death he was perhaps the most respected American philosopher of his generation). In his book The Nature of Rationality he gets, as is typical with philosophers, into amateur evolutionary arguments and writes the following: “Since not more than 50 percent of the individuals can be wealthier than average.” Of course, more than 50% of individuals can be wealthier than average. Consider that you have a very small number of very poor people and the rest clustering around the middle class. The mean will be lower than the median. Take a population of 10 people, 9 having a net worth of $30,000 and 1 having a net worth of $1,000. The average net worth is $27,100 and 9 out of 10 people will have above average wealth.

Figure 6.1 shows a series of points starting with an initial level W0 and ending at the period concerned Wt. It can also be seen as the performance, hypothetical or realized, of your favorite trading strategy, the track record of an investment manager, the price of a foot of average Palazzo real estate in Renaissance Florence, the price series of the Mongolian stock market, or the difference between the U.S. and Mongolian stock markets. It is composed of a given number of sequential observations W1, W2, etc., ordered in such a way that the one to the right comes after the one to the left.

Figure 6.1 A Primer on Time Series

If we were dealing with a deterministic world—that is, a world stripped of randomness (the right-column world in Table P.1), and we knew with certainty that it was the case, things would be rather easy. The pattern of the series would reveal considerable and predictive information. You could tell with precision what would happen one day ahead, one year ahead, and perhaps even a decade ahead. We would not even need a statistician; a second-rate engineer would do. He does not even need to be armed with a modern degree; someone with nineteenth-century training under Laplace would be able to solve the equations, called differential equations, or, equivalently, equations of motion—since we are studying the dynamics of an entity whose position depends on time.

If we were dealing with a world where randomness is charted, things would be easy as well, given that there is an entire field created for that called Econometrics or Time Series Analysis. You would call a friendly econometrician (my experience of econometricians is that they are usually polite and friendly to practitioners). He would run the data in his software, and provide you with diagnostics that would tell you if it is worth investing in the trader generating such a track record, or if it is worth pursuing the given trading strategy. You can even buy the student version of his software for under $999 and run it yourself during the next rainy weekend.

But we are not sure that the world we live in is well charted. We will see that the judgment derived from the analysis of these past attributes may on occasion be relevant. But it may be meaningless; it could on occasion mislead you and take you in the opposite direction. Sometimes market data becomes a simple trap; it shows you the opposite of its nature, simply to get you to invest in the security or mismanage your risks. Currencies that exhibit the largest historical stability, for example, are the most prone to crashes. This was bitterly discovered in the summer of 1997 by investors who chose the safety of the pegged currencies of Malaysia, Indonesia, and Thailand (they were pegged to the U.S. dollar in a manner to exhibit no volatility, until their sharp, sudden, and brutal devaluations).

We could be either too lax or too stringent in accepting past information as a prediction of the future. As a skeptic, I reject a sole time series of the past as an indication of future performance; I need a lot more than data. My major reason is the rare event, but I have plenty of others.

On the surface, my statement here may seem to contradict earlier discussions, where I blame people for not learning enough from history. The problem is that we read too much into shallow recent history, with statements like “this has never happened before,” but not from history in general (things that never happened before in one area tend eventually to happen). In other words, history teaches us that things that never happened before do happen. It can teach us a lot outside of the narrowly defined time series; the broader the look, the better the lesson. In other words, history teaches us to avoid the brand of naive empiricism that consists of learning from casual historical facts.

THE RARE-EVENT FALLACY

The Mother of All Deceptions

The rare event, owing to its dissimulative nature, can take a variety of shapes. It is in Mexico that it was spotted first, where it was called by academics the peso problem. Econometricians were puzzled by the behavior of the Mexican economic variables during the 1980s. The money supply, interest rates, or some similar measure of small relevance to the story exhibited some moody behavior, thwarting many of their efforts at modeling them. These indicators erratically switched between periods of stability and brief bursts of turbulence without warning.

By generalization, I started to label a rare event as any behavior where the adage “beware of calm waters” can hold. Popular wisdom often warns of the old neighbor who appears to remain courtly and reserved, the model of an excellent citizen, until you see his picture in the national paper as a deranged killer who went on a rampage. Until then, he was not known to have committed any transgression. There was no way to predict that such pathological behavior could emanate from such a nice person. I associate rare events with any misunderstanding of the risks derived from a narrow interpretation of past time series.

Rare events are always unexpected, otherwise they would not occur. The typical case is as follows. You invest in a hedge fund that enjoys stable returns and no volatility, until one day, you receive a letter starting with “An unforeseen and unexpected event, deemed a rare occurrence . . .” (emphasis mine). But rare events exist precisely because they are unexpected. They are generally caused by panics, themselves the results of liquidations (investors rushing to the door simultaneously by dumping anything they can put their hands on as fast as possible). If the fund manager or trader expected it, he and his like-minded peers would not have invested in it, and the rare event would not have taken place.

The rare event is not limited to one security. It can readily affect the performance of a portfolio. For example, many traders engage in the purchase of mortgage securities and hedge them in some manner to offset the risks and eliminate the volatility, hoping to derive some profits in excess of the Treasury bond returns (which is used as the benchmark of the minimum expected returns on an investment). They use computer programs and draw meaningful assistance from Ph.D.s in applied mathematics, astrophysics, particle physics, electrical engineering, fluid dynamics, or sometimes (though rarely) plain Ph.D.s in finance. Such a portfolio shows stable returns for long periods. Then, suddenly, as if by accident (I consider that no accident), the portfolio drops by 40% of its value when you expect, at the worst, a 4% drop. You call the manager to express your anger and he tells you that it was not his fault, but somehow the relationship dramatically changed (literally). He will also point out to you that similar funds also experienced the same problems.

Recall that some economists call the rare event a “peso problem.” The designation peso problem does not appear to be undeservedly stereotypical. Things have not gotten better since the early 1980s with the currency of the United States’ southern neighbor. Long periods of stability draw hordes of bank currency traders and hedge fund operators to the calm waters of the Mexican peso; they enjoy owning the currency because of the high interest rate it commands. Then they “unexpectedly” blow up, lose money for investors, lose their jobs, and switch careers. Then a new period of stability sets in. New currency traders come in with no memory of the bad event. They are drawn to the Mexican peso, and the story repeats itself.

It is an oddity that most fixed-income financial instruments present rare events. In the spring of 1998, I spent two hours explaining to a then-important hedge fund operator the notion of the peso problem. I went to great lengths to explain to him that the concept was generalized to every form of investment that was based on a naive interpretation of the volatility of past time series. The reply was:“ You are perfectly right. We do not touch the Mexican peso. We only invest in the Russian ruble.” He blew up a few months later. Until then, the Russian ruble carried attractive interest rates, which invited yield hogs of all types to get involved. He and other holders of investments denominated in rubles lost close to 97% of their investment during the summer of 1998.

We saw in Chapter 3 that the dentist does not like volatility as it causes a high incidence of negative pangs. The closer he observes his performance, the more pain he will experience owing to the greater variability at a higher resolution. Accordingly investors, merely for emotional reasons, will be drawn into strategies that experience rare but large variations. It is called pushing randomness under the rug. Psychologists recently found out that people tend to be sensitive to the presence or absence of a given stimulus rather than its magnitude. This implies that a loss is first perceived as just a loss, with further implications later. The same with profits. The agent would prefer the number of losses to be low and the number of gains to be high, rather than optimizing the total performance.

We can look at other aspects of the problem; think of someone involved in scientific research. Day after day, he will engage in dissecting mice in his laboratory, away from the rest of the world. He could try and try for years and years without anything to show for it. His significant other might lose patience with the loser who comes home every night smelling of mice urine. Until bingo, one day he comes up with a result. Someone observing the time series of his occupation would see absolutely no gain, while every day would bring him closer in probability to the end result.

The same with publishers; they can publish dog after dog without their business model being the least questionable, if once every decade they hit on a Harry Potter string of super-bestsellers—provided of course that they publish quality work that has a small probability of being of very high appeal. An interesting economist, Art De Vany, manages to apply these ideas to two fields: the movie business and his own health and lifestyle. He figured out the skewed properties of the movies payoffs and brought them to another level: the wild brand on nonmeasurable uncertainty we discuss in Chapter 10. What is also interesting is that he discovered that we are designed by mother nature to have an extremely skewed physical workout: Hunter-gatherers had idle moments followed by bursts of intense energy expenditure. At sixty-five, Art is said to have the physique of a man close to half his age.

In the markets, there is a category of traders who have inverse rare events, for whom volatility is often a bearer of good news. These traders lose money frequently, but in small amounts, and make money rarely, but in large amounts. I call them crisis hunters. I am happy to be one of them.

Why Don’t Statisticians Detect Rare Events?

Statistics to the layman can appear rather complex, but the concept behind what is used today is so simple that my French mathematician friends call it deprecatorily “cuisine.” It is all based on one simple notion: the more information you have, the more you are confident about the outcome. Now the

problem: by how much? Common statistical method is based on the steady augmentation of the confidence level, in nonlinear proportion to the number of observations. That is, for an n times increase in the sample size, we increase our knowledge by the square root of n. Suppose I am drawing from an urn containing red and black balls. My confidence level about the relative proportion of red and black balls after 20 drawings is not twice the one I have after 10 drawings; it is merely multiplied by the square root of 2 (that is, 1.41).

Where statistics becomes complicated, and fails us, is when we have distributions that are not symmetric, like the urn above. If there is a very small probability of finding a red ball in an urn dominated by black ones, then our knowledge about the absence of red balls will increase very slowly—more slowly than at the expected square root of n rate. On the other hand, our knowledge of the presence of red balls will dramatically improve once one of them is found. This asymmetry in knowledge is not trivial; it is central in this book—it is a central philosophical problem for such people as the ancient skeptics David Hume and Karl Popper (on that, later).

To assess an investor's performance, we either need more astute, and less intuitive, techniques or we may have to limit our assessments to situations where our judgment is independent of the frequency of these events.

A Mischievous Child Replaces the Black Balls

But there is even worse news. In some cases, if the incidence of red balls is itself randomly distributed, we will never get to know the composition of the urn. This is called "the problem of stationarity." Think of an urn that is hollow at the bottom. As I am sampling from it, and without my being aware of it, some mischievous child is adding balls of one color or another. My inference thus becomes insignificant. I may infer that the red balls represent 50% of the urn while the mischievous child, hearing me, would swiftly replace all the red balls with black ones. This makes much of our knowledge derived through statistics quite shaky.

The very same effect takes place in the market. We take past history as a single homogeneous sample and believe that we have considerably increased our knowledge of the future from the observation of the sample of the past. What if vicious children were changing the composition of the urn? In other words, what if things have changed?

I have studied and practiced econometrics for more than half my life (since I was nineteen), both in the classroom and in the activity of a quantitative derivatives trader. The "science" of econometrics consists of the application of statistics to samples taken at different periods of time, which we called "time series." It is based on studying the time series of economic variables, data, and other matters. In the beginning, when I knew close to nothing (that is, even less than today), I wondered whether the time series reflecting the activity of people now dead or retired should matter for predicting the future. Econometricians who knew a lot more than I did about these matters asked no such question; this hinted that it was in all likelihood a stupid inquiry. One prominent econometrician, Hashem Pesaran, answered a similar question by recommending to do "more and better econometrics." I am now convinced that, perhaps, most of econometrics could be useless—much of what financial statisticians know would not be worth knowing. For a sum of zeros, even repeated a billion times, remains zero; likewise an accumulation of research and gains in complexity will lead to naught if there is no firm ground beneath it. Studying the European markets of the 1990s will certainly be of great help to a historian; but what kind of inference can we make now that the structure of the institutions and the markets has changed so much?

Note that the economist Robert Lucas dealt a blow to econometrics by arguing that if people were rational then their rationality would cause them to figure out predictable patterns from the past and adapt, so that past information would be completely useless for predicting the future (the argument,

phrased in a very mathematical form, earned him the Swedish Central Bank Prize in honor of Alfred Nobel). We are human and act according to our knowledge, which integrates past data. I can translate his point with the following analogy. If rational traders detect a pattern of stocks rising on Mondays, then, immediately such a pattern becomes detectable, it would be ironed out by people buying on Friday in anticipation of such an effect. There is no point searching for patterns that are available to everyone with a brokerage account; once detected, they would be self-canceling.

Somehow, what came to be known as the Lucas critique was not carried through by the “scientists.” It was confidently believed that the scientific successes of the industrial revolution could be carried through into the social sciences, particularly with such movements as Marxism. Pseudoscience came with a collection of idealistic nerds who tried to create a tailor-made society, the epitome of which is the central planner. Economics was the most likely candidate for such use of science; you can disguise charlatanism under the weight of equations, and nobody can catch you since there is no such thing as a controlled experiment. Now, the spirit of such methods, called scientism by its detractors (like myself), continued past Marxism, into the discipline of finance as a few technicians thought that their mathematical knowledge could lead them to understand markets. The practice of “financial engineering” came along with massive doses of pseudoscience. Practitioners of these methods measure risks, using the tool of past history as an indication of the future. We will just say at this point that the mere possibility of the distributions not being stationary makes the entire concept seem like a costly (perhaps very costly) mistake. This leads us to a more fundamental question: The problem of induction, to which we will turn in the next chapter.