

Against The Gods

Peter Bernstein

Introduction

- p.1 Mastering risk is what separates modern times from the past
- p.2 Risk management guides decision making by identifying what may happen in the future and identifying alternatives
- p.3 First real study of risk began in the Renaissance
Theory of probability provides a mathematical definition of risk
- p.6 Controversy between two groups that has yet to be resolved (major theme of the book)
 - 1) Those who believe the best decisions are based on numbers
 - 2) Those who base their decisions on more subjective beliefs about the uncertain future"But to what degree should we rely on the patterns of the past to tell us what the future should be?"
- p.7 Fischer Black: "Markets look a lot less efficient from the banks of the Hudson than from the banks of the Charles."

The Winds Of The Greeks And The Role Of The Dice

- p.12 Adam Smith & Keynes: "we don't take risks with the expectation that we will fail. Taking risks allows us to make progress. But taking too much risk can lead to bad results"
- p.14 Two types of gambling games:
 - 1) Games of chance
 - 2) Games of skillGames of chance require only knowledge of probabilities while games involving skill require much more information
- p.15 Time plays a critical factor in risk
"Time transforms risk and the nature of risk is shaped by the time horizon: the future is the playing field."
- p.20 Renaissance and Protestant Reformation set the stage for mastering risk. People had to face choices about the uncertain future, which offered both opportunity and danger

As Easy As I, II, III

- p.24 Numbers are necessary to calculate probabilities and play an important role in defining risk
Fibonacci was the first to define mathematical rules of numbers and use them in practical applications through his book "Liber Abaci"
- p.30 Greeks contribution to mathematics was the process of thinking about "why" rather than simply "what"-
-they insisted on proof. However, they were hindered by a number system based on alphabetic letters, similar to the Romans
- p.33 Arabs did earliest work in algebra (al-Khowarizmi)--rules for adding, subtracting, multiplying and dividing
- p.35 A number of cultures (Greeks, Romans and Arabs) made great advancements in mathematics, but fell short of reaching logical conclusions and working with probabilities. Bernstein reckons that this was due to how these cultures viewed their lives.
"The idea of risk management emerges only when people believe that they are to some degree free agents."
Acceptance of a new numbering system was slow for several reasons

- 1) New methods that change what has been used for centuries are slow to adopt
- 2) Easy to commit fraud on handwritten numbers by changing a given number into another (i.e. a 1 into a 7)

Renaissance Gambler

- p.43 Paccioli's "Summa" poses the question: how are the stakes divided in an uncompleted game?
This question began a systematic analysis of probability and how to measure our confidence that something is about to happen
- p.48 Girolamo Cardano, a gambling addict, physician and part time mathematician wrote the first serious effort on probabilities in "Liber de Ludo Aleae"
"Probability has always carried this double meaning, one looking into the future, the other interpreting the past, one concerned with our opinions, the other concerned with what we actually know."
- p.53 Difference between probability and odds
-Probability: ratio of favorable outcomes to total opportunity
-Odds: ratio of favorable outcomes to unfavorable outcomes
- p.54 "Liber de Ludo Aleae" is the first known effort to put measurement at the service of risk
- p.55 Galileo dealt with problems of throwing dice

The French Connection

- p.58 Three Frenchmen: Pascal, de Mere and Fermat
- p.63 Pascal and Fermat construct a systematic method for analyzing future outcomes related to Paccioli's question (how to divide stakes in an uncompleted game)
- p.64 Pascal's Triangle
- p.71 Initial concept that both magnitude of consequences as well as probabilities should influence a decision

The Remarkable Notions Of The Remarkable Notions Man

- p.73 We must make decisions using limited amounts of data (sampling)
- p.75 John Graunt: tradesman who compiled records of births and deaths in London from 1604 to 1661
- p.78 Graunt developed the technique of "statistical inference" in his analysis
- p.82 Graunt's concept of probability, tabulated number of survivors out of 100 from age 6 to 76
- p.86 Edmund Halley takes Graunt's work a step further and develops more detailed probabilities of life expectancy. He then proceeds to begin valuing annuities
- p.88 Insurance companies and stockbrokers first organized in coffee houses in London during the late 17th century
- p.90 Lloyd's of London started as a coffee house that published "Lloyd's List" of shipping information, eventually expanded to stock prices and foreign markets information
Brief history of insurance

Considering The Nature Of Man

- p.100 Decisions relating to risk have two distinct inseparable elements:
- 1) Objective facts
 - 2) Subjective view regarding the desirability of what is to be gained or lost
- Daniel Bernoulli "New Theory": value of an item must not be based on its price, but rather on the utility that it yields

- p.103 Bernoulli: "the utility... is dependent on the particular circumstances of the person making the estimate... There is no reason to assume that... the risks anticipated by each [individual] must be deemed equal to value."
Utility: a sense of usefulness, desirability and satisfaction
- p.105 "If everyone valued every risk in precisely the same way, many risky opportunities would be passed up."
Pivotal idea: converts calculation of probabilities, allows for inclusion of subjectivity into decisions that have uncertain outcomes
"[The] utility resulting from any small increase in wealth will be inversely proportionate to the quantity of goods previously possessed."
- p.106 Facts are intended to provide a single answer, while subjectivity can introduce many answers
Petersburg Paradox
-Assumption is that increases in wealth are inversely related to initial wealth
-Prospects are valued at infinity, much like growth companies
- p.108 Nifty-Fifty
- p.109 Bernoulli addresses human capital: wealth is "anything that can contribute to the adequate satisfaction of any sort of want..."
Tangible assets and financial claims are less valuable than productive capacity (Thought: this is similar to Buffett's view on gold and bonds, which are nonproductive assets)
- p.110 Human capital is the sum of our education, experience, talent and training and is the largest contributor to our future earnings
- p.111 "Utility theory requires that a rational person be able to measure utility under all circumstances and to make choices and decisions accordingly
Bold notion: we each have our own set of values and respond accordingly
- p.112 Disutility caused by a loss of wealth will always exceed the positive utility provided by a gain of equal size--losses hurt more than gains
Games of chance that are zero sum are loser's games and both sides should refuse to play

The Search For Moral Certainty

- p.117 Probability theory is used for forecasting, but depends greatly on the quality of information
- p.118 Jacob Bernoulli: to arrive at a hypothesis of an event "it is necessary only to calculate exactly the number of possible cases, and then to determine how much more likely it is that one case will occur than another."
- p.121 Jacob Bernoulli's major contribution was to probability development
1) Was the first to use samples (limited amounts of information) to determine probabilities
2) Solution demands the assumption, that under similar circumstances the occurrence of a future event will follow the same pattern observed in the past.
Three requisite assumptions for managing risk
1) Full information
2) Independent trials
3) Relevance of quantitative valuation
- p.122 Law of large numbers
-Not to be used to validate observed facts
-the average of a large number of throws will be more likely than the average of a small number of throws to differ from the true average by less than some state amount

- p.126 Abraham De Moivre's "De Mensura Sortis" was one of the first to define risk as the chance of loss: "The Risk of losing any sum is the reverse of Expectation; and the true measure of it is, the product of the Sum adventured multiplied by the Probability of the Loss."
-gives rise to the normal distribution or "bell curve" and standard deviation
- p.132 Bayes: How we can determine probability that an event will occur under circumstances where we know nothing except that it has occurred a certain number of times and has failed to occur a certain number of other times
Bayes system uses new information to revise probabilities based on old information

The Supreme Law Of Unreason

- p.140 Gauss used large samples of measurements to measure the curvature of the Earth
- p.142 Francis Galton: two necessary conditions for observations to be normal distributed
1) As large a number of observations as possible
2) Observations must be independent
- p.143 Central Limit Theorem (Laplace): averages of averages will reduce the dispersion around the grand average
- p.145 Best way to determine whether changes are random is to see if they are normally distributed
Evidence exists to show stock prices are normally distributed
New information is random, consequently stock prices move unpredictably
- p.146 Two features of distribution of stock price changes:
1) prices fluctuate, a lot can happen in either direction (up or down)
2) more observations are to the right of zero than to the left--the market has gone up on average more than it has gone down
- p.150 "At the extremes, the market is not a random walk."
- p.151 "Much risk-taking rests on the opportunities that develop from deviations from normal."

The Man With The Sprained Brain

- p.156 Galton's goal was to understand how talent persists through generation after generation in certain families
- p.157 Galton references work of Belgian scientist Quetelet
- p.160 Quetelet used statistics to determine cause and effect in populations related to the social structures and physical attributes of humans
Almost all observations were normally distributed
- p.163 Galton sought to prove that eminence--high status--was due to heredity alone
- p.164 Result of Galton study was that eminence does not last long, needed to explain differences within the distribution
- p.166 Since few people in a large group are eminent, few of their offspring will likely be eminent. Since most people are average, their offspring will be average.
Regression/reversion to the mean: mediocrity always outnumbers talent

Peapods And Perils

- p.172 Three reasons why regression to the mean is a frustrating guide to decision making
1) Regression process is so slow that a shock can disrupt the process

2) Regression may be so strong that the situation does not rest once the mean is achieved (overshoot or undershoot)

3) The mean itself may be unstable

p.174 If regression to the mean exists in the stock market, then prices are predictable, but under what conditions?

p.175 "If the winners kept on winning and the losers kept on losing, our economy would consist of a shrinking handful of giant monopolies and virtually no small companies at all."

p.177 The only thing that makes stock prices change is the availability of new information, which is unknown, and therefore no known mean for prices to revert to

p.179 Long-run market volatility is less than it would be if the extremes had any chance of taking over, Uncertainty about rates of return, over the long run, is much smaller than in the short run

p.180 Overreaction to new information (DeBondt & Thaler) regarding stock price behavior is a consequence of humans to overweight recent evidence and lose sight of the long run.

p.184 At around 1959 the relationship between stocks and bonds changed, stocks began to yield less than bonds

The Fabric Of Felicity

p.187 Under conditions of uncertainty, both rationality and measurement are essential to decision making

p.190 William Stanley Jevons: value depends on utility. Utility varies with the quantity of commodity already in one's possession

The Measure Of Our Ignorance

p.197 "When we say that someone has fallen on bad luck, we relieve that person of any responsibility for what has happened. When we say that someone has had good luck, we deny that person credit for the effort that might have led to the happy outcome. But how sure can we be? Was it fate or choice that decided the outcome?"

p.198 Difficult to find cause where there seems to be none, but should be careful not to assign a particular cause to an outcome when in fact only the laws of probability are at work.

p.200 If all causes are known, then the effects can be predicted

Poincare: "what is chance for the ignorant is not chance for the scientist. Chance is only the measure of our ignorance."

p.202 It is difficult to get all the pieces of necessary information together to make a decision. We never know for sure how good our sample is. This gives rise to uncertainty

We fall back on inductive reasoning--attempting to guess the odds

p.203 We prefer a gamble that has 100% odds on a small loss but a small chance of a large gain to a gamble with a certain small gain but with uncertain and potentially ruinous consequences

p.204 Kenneth Arrow: The world would be a better place if we could insure against every future possibility. Then more people would be willing to engage in risk taking, without which economic progress is impossible

p.206 A society in which no one fears the consequences of risk taking may provide fertile ground for antisocial behavior. Wherever insurance is available, moral hazard--the temptation to cheat--will be present

p.207 "We are never certain; we are always ignorant to some degree. Much of the information we have is either incorrect or incomplete

Under uncertainty, the choice is not rejecting or accepting a hypothesis, but rejecting or not rejecting the hypothesis

For scientific research to be valid the hypothesis must be subject to falsification and testable

Thought: How to test if a fund manager has skill or results are luck? t-test?

The Radically Distinct Notion

p.217 Knight and Keynes were the first to confront the following idea: "... only the most naive theorist could pretend that all problems could be solved through the application of differential calculus and the laws of probability with well-ordered preferences. Mathematicians and philosophers had to admit that reality encompassed entire sets of circumstances that people had never contemplated before."

p.219 Knight's distinction between uncertainty and risk

p.220 In classic economics, buyers, sellers, workers and capitalists always have all the information they need. In instances where the future is unknown, laws of probability will determine the outcome

Thought: does this relate to the efficient market hypothesis?

p.221 Prevalence of surprise (related to profits or performance) in the business world demonstrates that uncertainty is more likely to prevail than probability (we regularly extrapolate the past to the future, but fail to acknowledge when conditions are changing)

Security prices represent a consensus view of future expectations, which either never occur or change since prices are constantly changing

p.225 Keynes suggests that objective probabilities of future events do not exist, our ignorance of future events denies us the certainty of knowing what that future probability is

p.226 Keynes rejects the law of large numbers, simply because something occurred in the past does not mean it will occur in the future

p.227 Keynes view of economics revolves around uncertainty

"A system that cannot rely on the frequency distribution of past events is peculiarly vulnerable to surprise and is inherently volatile

p.228 Keynes: interest is a reward for parting with liquidity

Uncertainty rather than mathematical probability is the ruling paradigm in the real world

p.229 "A tremendous idea lies buried in the notion that we simply do not know."

The Man Who Counted Everything Except Calories

p.232 Game theory: the true source of uncertainty lies in the intentions of others

"almost every decision is the result of a series of negotiations in which we try to reduce uncertainty by trading off what other people want in return for what we want ourselves."

Game theory invented by John von Neumann

p.234 match-penny game

rational decision making by both players results in a 50-50 payoff, not the probability--the players themselves cause the result

p.236 Oskar Morgenstern: economics could not be used for predicting business activity, no one can know what everybody else is going to do at any given moment

p.238 von Neumann and Morgenstern author "The Theory of Games and Economic Behavior"

p.239 Same principle as Bernoulli: utility of increases in wealth is inversely related to the amount of wealth already possessed

p.242 Nash Equilibrium

- p.245 "Theory of Games and Economic Behavior" based on one essential element of behavior: winnings received by maximizing utility (makes the best tradeoffs given the constraints set by the game) will depend upon how much can be received by behaving rationally--more can be received when others make mistakes
- p.246 "Measurement always dominates intuition: rational people make choices on the basis of information rather than on the basis of whim, emotion, or habit. Once they have analyzed all the available information, they make decisions in accord with well-defined preferences. They prefer more wealth to less and strive to maximize utility. But they are also risk-averse in the Bernoullian sense that the utility of additional wealth is inversely related to the amount already possessed."

The Strange Case Of The Anonymous Stockbroker

- p.248 Markowitz: "Portfolio Selection"--main theme was that a portfolio of securities behaves entirely different from the individual holdings
- p.251 Investors in stocks and bonds have no control over the returns that they will earn. However, they can control the risks that they take
- p.252 Markowitz used the concept of variance to quantify risk in his portfolio construction paradigm. Expected returns were the desirable thing and variance of return an undesirable thing
Diversification is the best weapon against variance of return
- p.253 Return on a diversified portfolio will be equal to the average of the rates of return on its individual holdings, its volatility will be less than the average volatility of its individual holdings
- p.256 Efficient portfolios minimize variance while simultaneously maximizing return
- p.257 Selection of a portfolio's objective--either aggressive or defensive--is the only subjectivity involved in the Markowitz system
Criticisms of "Portfolio Selection"
- 1) Are investors rational enough to follow Markowitz's prescription
 - 2) Is variance the correct measure of risk
 - 3) Does the assumed positive relationship of return and risk hold up
 - 4) Difficult to estimate inputs (expected returns, variances and covariances)
 - 5) Data that are not normally distributed may fail to reflect 100% of the uncertainties of the portfolio
- p.260 Morningstar: mutual funds with the highest 12b-1 fees also had higher standard deviations (volatility as a proxy for risk)
- p.261 Robert Jeffrey: "The real risk in holding a portfolio is that it might not provide its owner, either during the interim or at some terminal date or both, with the cash he requires to make essential outlays." (Risk is simply the chance of losing money)
- p.262 Returns can also be considered as a measure of risk if a portfolio fails to provide a desired rate of return
- p.264 William Sharpe: relationship between changes in wealth and willingness to own risky assets "The consequence is that increases in wealth tend to strengthen the appetite for risk while losses tend to weaken it."

The Failure Of Invariance

- p.270 Human behavior is constantly regressing towards a mean performance at any given point in time and is unlikely to continue improving or declining indefinitely
- p.271 Patterns of human behavior are caused by two shortcomings:
- 1) Emotion destroys self control that is essential in making rational decisions

- 2) People are unable to fully understand what they are dealing with (cognitive difficulties)
- p.270 Kahneman and Tversky develop Prospect Theory: how people manage risk and uncertainty
- p.271 Our human difficulty is sampling, using shortcuts that lead to erroneous perceptions or interpreting small samples as valid representations
- p.272 Risk aversion: the asymmetry between the way we make decisions involving gains and decisions involving losses
- p.273 people are willing to choose a gamble when they consider it appropriate, context matters
- p.274 Kahneman and Tversky contrast Bernoulli: the valuation of a risky opportunity depends more on the reference point, and less on the final value of assets
- p.275 "Failure of invariance" describes inconsistent choices when the same problem is posed in different frames
- p.277 Failure of invariance takes the form of mental accounting, where we separate the components of the resultant whole
- p.280 Daniel Ellsberg "ambiguity aversion": people prefer to take risks on the basis of known rather than unknown probabilities--information matters
- p.281 However, "people will bet on vague beliefs in situations where they feel especially competent or knowledgeable, but they prefer to bet on chance when they do not."
- p.282 Thaler: If we were always rational, we would not need elaborate systems to bolster our self control (dieting resorts, withholding income taxes, etc.)

The Theory Police

- p.284 Failure of the rational model is not the logic, but the human brain it requires. We would have to know and understand everything to be truly rational
- p.285 Decision regret: focusing on what might have been had the correct decision been made
- p.286 "Worldly wisdom teaches that it is better for reputation to fail conventionally than to succeed unconventionally."
- p.287 Behavioral finance field is a response to the flaws in the rational model. Identifies if investors are obeying or disobeying the laws of rational behavior
- p.289 "An Economic Theory of Self-Control" makes the point that people who have trouble exercising self-control deliberately limit their options
- p.290 Why do corporations pay dividends...Berkshire Hathaway as an example?
- p.291 "One side of our personality is an internal planner with a long-term perspective, an authority who insists on decisions that weight the future more heavily than the present. The other side seeks immediate gratification. These two sides are in constant conflict."
- p.292 Thaler & DeBondt: investors revise their beliefs when new information arrives by overweighting the new information (as opposed to Bayesian models) and underweighting longer-term information
Thought: implications for value stocks (these stocks are "oversold")
- p.294 Endowment Effect: describes our tendency to set a higher selling price on what we own than what we would pay for the identical item if we did not own it.
- p.297 In a fully rational market no one would outperform the market as a whole and all investors would earn the same rate of return
- p.302 Example of ambiguity aversion: we calculate probabilities from real life situations only when similar experiences have occurred enough to resemble the patterns of games of chance

The Fantastic System Of Side Bets

- p.304 Derivatives have existed for thousands of years
Have no value of their own and were developed out of the need to reduce risk
- p.305 Two types of derivatives:
1) Futures: contracts for future delivery at a specified price
2) Options: puts and calls
- p.307 Dutch tulip bubble involved trading options
- p.310 The key to valuing an option is the price of uncertainty
- p.312 The value of an option depends on four elements: time, prices, interest rates and volatility
- p.314 Derivatives act as a form of insurance
"The product in derivative transactions is uncertainty itself."
- p.315 Black-Scholes model for option valuation published in 1973
- p.317 Leland and Rubenstein replicate performance of a put option by dynamically changing the mix of cash and stocks--portfolio insurance
- p.320 October 19, 1987, Black Monday, portfolio insurance strategy underestimated market volatility and overestimated liquidity. The lead to portfolio insurance being more costly than anticipated
- p.321 Corporations began seeking ways to transfer risks in exchange rates, interest rates, and commodity prices--potential losses in these areas felt worse than potential gains (risk aversion influences strategy)
- p.322 Derivative contracts between corporations, in theory, work well for companies with opposite requirements. As an example: an oil company protecting itself from a fall in the price of crude oil could accommodate an airline protecting itself from a rise in oil prices. But perfect matches seldom exist
- p.323 Disasters in derivatives occur when corporations increase exposure to volatility rather than limiting it. Ignored the basic principle "you cannot expect to make large profits without taking the risk of large losses."

Awaiting The Wildness

- p.329 Leibniz's admonition of 1703: "Nature has established patterns originating in the return of events, but only for the most part."
Nature repeats itself, but in an imperfect way
Thought: statistics and probability provide a framework for decision making, but we still must contend with uncertainty and more importantly our own behavior
- p.334 "Likeness to truth is not the same as truth. Without any theoretical structure to explain why patterns seem to repeat themselves across time or across systems, these innovations provide little assurance that today's signals will trigger tomorrow's events."
- p.335 Science of risk management sometimes creates new risks while simultaneously controlling others