Against the Gods: The Remarkable Story of Risk

Reviewed by S. L. Zabell

Against the Gods:
The Remarkable Story of Risk
Peter L. Bernstein
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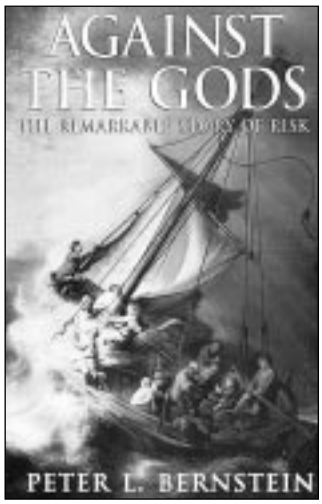
The thesis of this interesting and provocative book is that modern civilization is largely distinguished by its successful efforts first to understand and then to control risk. These efforts use, in part, tools of risk management that only became possible after the development of the mathematical subjects of probability and statistics. The author's method is largely historical and biographical: the five parts of the book cover the periods before 1200, 1200–1700, 1700–1900, 1900–1960, and 1960 to the present; the chapters in each part contain a series of one or more vignettes of important contributors to the subject. Many familiar names crop up—Cardano, Pascal, Fermat, Graunt, the Bernoullis, De Moivre, Bayes, Laplace, Galton, Keynes, and von Neumann—but also a number of individuals who will be less familiar: Baumol, Knight, Markowitz, Leland, Rubinstein, and Thaler.

Peter L. Bernstein is the president of a consulting firm for institutional investors and the author of six books on economics and finance. He brings an unusual and novel perspective to his historical survey of the development of the mathematics of chance and uncertainty. In the same chapter in which he discusses the work of John Graunt, for example, whose *Natural and Political Observations Made upon the Bills of Mortality* (1662) stands as the first great example of modern statistical data analysis, Bernstein also spends some time telling us about the genesis of Lloyd's of London, the famous insurance firm. This weaving of topics that are standard in the history of probability and statistics with many that are not is one of the strengths and attractions of the book. Another is the obvious zest with which Bernstein describes the many intriguing people and tantalizing mysteries so peculiar to the mathematics of chance.



The subject is certainly not lacking in its mysteries. The first great puzzle in its history is just why it took so long for the mathematics of chance to develop. The ancient Greeks certainly had both the necessary mathematical abilities and recreational interests, and yet there is not a hint of a systematic mathematical treatment of gambling in either their literature or that of the Middle Ages. Many explanations—mathematical, conceptual, and economic—have been proposed for this. The philosopher Ian Hacking, for example, whose influential and important book *The Emergence of*

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Probability (1975) created a resurgence of interest in the history of probability, suggested that a necessary and special concept of evidence, absent before the seventeenth century, had been a necessary precursor for the development of the mathematics of chance. This provocative if not entirely convincing thesis was inspired by the ideas of the controversial French structuralist philosopher Michel Foucault. Bernstein opts for a much more standard explanation: that a suitable notion of chance event was lacking.

The first book on the mathematics of games of chance in fact dates to the sixteenth century: the *Liber de Ludo Alaea* of Girolamo Cardano. Cardano was, by any account, a most curious figure. In his day a famous physician, he was also a mystic, a polymath, and a prolific author, best remembered by mathematicians today as the author of the *Ars Magna* (1545), which contains the first general discussion of the solution of the cubic equation. Mathematicians often live relatively uneventful lives, but Cardano did not. After persuading a reticient Nicolo Tartaglia to divulge his solution of the cubic under a strict pledge of secrecy, Cardano many years later described it in the *Ars Magna*. Even though Cardano acknowledged Tartaglia's priority, this incident sparked an extended and venomous exchange between the two. (Cardano's brilliant student Ferrari went on to provide a similar solution for the quartic.) Perversely, Cardano did not publish his own discoveries in the mathematics of gambling; they first appeared in print nearly a century after his death.

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The colorful Cardano is by no means unusual, for probability has, by any measure, a history replete with curious figures. There is the ascetic Blaise Pascal, who abandoned mathematics and the world to spend his last years as a Jansenist monk penning the *Pensées* that would win him immortality. There is the secretive James Bernoulli, a member of an enormously gifted but highly competitive family, whose proof of the law of large numbers (the first major limit theorem in mathematical probability) in his *Ars Conjectandi* (written around 1685) languished for nearly twenty years while he pondered its significance and ultimately appeared in 1713, eight years after his death. There is the Huguenot refugee Abraham De Moivre, who fled France in 1688 after the revocation of the Edict of Nantes three years earlier, but who, despite his membership in the Royal Society and friendship with Newton, was unable to obtain a university position and ended up spending his days teaching students and consulting at Slaughter's Coffee House in the Strand. Cardano and Bernoulli were not the only two who published only after they perished. There is the mysterious (but "ingenious", as many later described him) Thomas Bayes, whose mathematical works—published only after his death by his friend Richard Price—included both a short note pointing out for the first time the divergent nature of the asymptotic series for $\log n$, as well as his longer and more famous "Essay towards solving a problem in the doctrine of chances", later to bring him eponymous fame as the founder of "Bayesian statistics".

Following de Moivre and Bayes, dominance in mathematical probability (as in so many other mathematical subjects after the death of Newton) passed from England to France. The Marquis de Condorcet, one of the philosophes, enthusiastically argued for the uses of probability in arriving at a more rational judicial system before he, like the chemist Lavoisier, perished in the irrational terror of the French Revolution. (The Marquis was the victim of his aristocractic background and perhaps also of his fondness for omelettes: legend has it that his lineage was betrayed at a country inn by the large number of eggs he requested in an omelette). Condorcet's younger contemporary, Pierre Simon, the Marquis de Laplace, was at once both more politically agile and more mathematically powerful. He survived the Revolution and so lived to write his masterpiece, the *Théorie Analytique des Probabilités*, in 1812—a work whose subjective view of the nature of probability dominated the subject for nearly a century. Then the pendulum finally swung back to England and the English school of biometricians—Galton, Edgeworth, Pearson, Gosset, and Fisher—who, eclectically building on these foundations, crafted the beginnings of modern statistical science, applying the mathematics of chance to the collection, summarization, and analysis of data.

This initial part of Bernstein's book is related with vigor and enthusiasm. It is not the work of a professional historian, but this does not seem particularly important; the book is for the most part accurate in its details and certainly accurate in the overall picture it conveys. There are some minor errors of fact (for example, Cardano, who was born in 1501 and died in 1576, is reported to have been born "about 1500 and died in 1571"). Such errors as exist, however, are neither particularly serious or pervasive, and to harp on them would be churlish and misleading. Bernstein's purpose is to depict the rise of risk management, combining many different strands in a long and complex story, and in this he certainly succeeds.

This is, of course, a very broad canvas to depict, and it is not surprising that some parts of his synthesis are more effectively drawn than others. It is in the second half of the book that Bernstein seems particularly in his element, as he discusses the work of Arrow, Keynes, Knight, and von Neumann on game theory (Chapter 14); Harry Markowitz on portfolio selection (Chapter 15); Kahneman and Tversky on prospect theory (Chapter 16); Thaler, Shefrin, and Statman on behavioral finance (Chapter 17); and the use of derivatives and other financial instruments in risk management (Chapter 18). The author tells this part of his history with an attractive verve, and, if anything, one finds oneself wishing that he had spent even more time on this portion than he does.

The book does have some weaknesses. One is that its presentation of certain topics in statistics is occasionally confused or confusing. (The discussions of normality and its relationship to independence on pp. 144–150 and of regression to the mean on pp. 167–170 and 173–174 are two examples.) On the other hand, Bernstein's discussion of many other topics (for example, the binomial distribution and the work of Kahneman and Tversky) are models of clarity, outstanding examples of popular exposition. The book also resorts on a number of occasions to an unnecessary hyperbole. Is it really the case that "Nothing is more soothing or more persuasive than the computer screen" (p. 336) or that "Proponents of chaos theory … claim to have revealed the hidden source of inexactitude" (p. 332)? Surely not.

But these are minor blemishes. Bernstein has written an interesting, amusing, unpretentious, and attractive book. It discusses a number of neglected topics, provides a fresh outlook on some of the more standard ones, and should stimulate many of its readers to go further into both the fascinating literature of the history of probability and statistics and modern economic applications of these subjects.