

February 21, 1997

The uses and abuses of risk management

How men learnt to bet against the gods

By Kenneth Anderson

Times Literary Supplement Book Review

AGAINST THE GODS. The remarkable story of risk. Peter L. Bernstein. 383pp.
Chichester: Wiley. £17.99. - 0 471 12104 5

MANAGING DERIVATIVE RISKS. The use and abuse of leverage. Lillian Chew.
313pp. New York: Wiley. £27.50. - 0 471 95622 8

Although I learned to play chess as a child, playing cards was frowned on in my family's Mormon household, and I have never learned to play poker, bridge, hearts, blackjack, 21, gin rummy or even solitaire (patience). It is an educational gap I now regret, because chess and poker are crucially different: in chess, the game's fundamental information is available on the board at every moment, except that one player does not know how another player will play. Pure chance, however, literally the luck of the draw, figures in the outcome of poker. Luck, and therefore the reduction of luck's role through the playing of probabilities, matters. Never having played card games, I have never been comfortable with the intuitive estimation of probability.

More precisely, for reasons Peter L. Bernstein's new book, *Against the Gods: The remarkable story of risk*, makes clear, like many people I have never been comfortable relying on probability to hedge against luck, which is no doubt why I am a modestly compensated law professor and not a fabulously compensated Wall Street punter. The laws of probability, Bernstein explains, bring luck and fate, as the ancients conceived them, under the bright light of systematic reason and thus under human control, over the long run of dice rolls, even if not in any specific roll - to manage risk, in modern parlance. *Against the Gods* is an intellectual history of the idea of risk and risk management. It is a singular achievement - I am unaware of anything quite like it - for it melds intellectual and mathematical history, on the one hand, and finance, on the other, into a sweeping thesis that modernity is the control of risk, the demystification of mysterious fortune and fate.

It is not merely that modernity, through science and technology, dethrones the fatal will of the gods in favour of the laws of causation; this is true, but not the whole story. Modernity also, and perhaps more crucially, recognizes pervasive and permanent uncertainty, which will not in all cases give way inexorably before the explication of cause and effect. Uncertainty remains with us, but it is domesticated and reconfigured by the laws of probability into manageable patterns and thence into the quotidian modern mechanisms for dealing with risk, exemplified by life insurance, annuities, actuarial

tables, carcinogens fed to rats to determine rates of cancer, and repetitions of automobile crashes with crash-test dummies to determine the risks and benefits of air bags. Bernstein shows just how central to modernity these ordinary institutions of risk management are; he causes us to think back, for example, to the early modern period when the anxiety to establish reliable insurance rates on ships' cargoes and, later, fire insurance was palpable in the life of the dockside London cafes where began the insurance pools which led eventually to Lloyd's and beyond.

Indeed, *Against the Gods* implies that the traditional antipathy between the Church and commerce across many centuries may have arisen partly because commerce found ways to insure itself against losses that otherwise would have remained attributable only to the unfathomable will of God. The merchant and his commerce are unholy, not merely because they worship Mammon over God, but in part because the merchant's access to insurance allows him to bet against God: is He not thereby mocked? And thus the merchant appropriates Laplace's famous reply to Napoleon as to the existence of God, "Sir, I have no need of that hypothesis." Bernstein closes the book arguing, with considerable acuity, that modernity's ideal of autonomy is possible only through a knowledge of the laws of probability and uncertainty, because they provide the grounds for rational risk-taking that rational autonomy requires. Knowledge of uncertainty's forms turns fate into freedom.

Some of the risk-management devices Bernstein describes are very old; life annuities, for example, were offered by various medieval municipalities. And many of today's financial "derivatives" are just more elaborate versions of the agricultural forward contract, which reaches far back into ancient civilizations as a mechanism by which farmers obtained a secure future price for their harvests. Yet as Bernstein points out, notwithstanding these financial arrangements in antiquity, not even the most mathematically sophisticated pre-modern civilizations grappled with the problem of risk - the medieval municipalities, for example, lacked both empirically accurate estimates of life expectancy and the mathematics to calculate the value of annuities. The Greeks, for their part, were sophisticated in the analysis of cause and effect and well acquainted with games of chance, but it did not occur to them to consider chance systematically.

Part of this was surely due to the lack of an adequate number system - unsurprisingly, one of the few early mathematicians to come close to analysing probability was an Arab, Omar Khayyam (c 1050). Perhaps, too, it was partly due to the development of many quantitative concepts out of the absolute regularity of astronomical phenomena or from geometry. Risk was not systematically explored until 1494, when Luca Paccioli published his treatise on mathematics; mixed in with the new Arabic arithmetic was the so-called problem of the points: A and B are playing a fair game of balla. They agree to continue until one has won six rounds. The game actually stops when A has won five and B three. How should the stakes be divided?

In other words, how to divide the stakes in an uncompleted game?

The motives of those seeking to answer this classic puzzle are in some respects as striking as the gradual evolution of their answers. The earliest came, naturally enough, from a Renaissance gambler, Girolamo Cardano, but in the seventeenth century Fermat and Pascal took up the question in a correspondence that laid the mathematical foundations for much of what followed. Fermat, the lawyer for whom (Fermat's Last Theorem notwithstanding) mathematics was a sideline, and Pascal, the religious mystic who turned these same ideas into Pascal's Wager, each understood dividing the stakes to involve fundamental questions of fairness. One player is ahead and more likely to win, and so a merely equal division of the stakes would be unjust. The answers they gave - Fermat through algebra, Pascal through geometry - provide for the first time a systematic method for describing the probabilities of future events dependent on chance, such as, for example, the probable number of boys or girls in a multi-child family.

But this is only the beginning, because the problem of the points is only about chance, but the roll of dice is merely one variety of uncertainty. There are many others. Indeed, the ordering of Bernstein's chapters reveals the logical (and simultaneously historical) progression by which forms of uncertainty become increasingly disconnected from mere randomness and increasingly connected with the uncertainties of human behaviour: uncertainties measuring empirical phenomena where one must rely on necessarily incomplete samples; uncertainties of the subjective preferences giving rise to utility and disutility, declining marginal utility and risk aversion, as the economists know them; uncertainties of the bell curve, distribution around the mean, regression towards the mean, and the very equivalence of "variance" and "risk"; uncertainties of game theory, in which each player must guess at others' strategies; uncertainties of "irrational" human behaviour that departs from the norms of economists and statisticians; and uncertainties of complex systems that defy conventional causal analysis, giving rise to chaos theory.

Bernstein handles these topics, and the scientists and mathematicians who pioneered them, with verve. The book is aimed at the general lay reader and deserves, by its subject-matter, intellectual importance and readable prose, to attract a wide audience. Professional historians will no doubt be dissatisfied with *Against the Gods'* sweeping pronouncements; much of it is a synthesis of secondary sources. Moreover, the book's underlying thesis about risk management, freedom and modernity is open to considerable skepticism, despite its usefulness as an organizing principle for the successive chapters. But the failure of some of Bernstein's intellectual claims does not detract from the sketches of ideas and men that the book provides - and the sense of progression connecting them.

More intellectually troubling is the tendency to treat some of these techniques for quantifying and managing forms of risk and uncertainty as themselves metaphysically grounded. Whatever else it is, statistics is not metaphysics, but there are odd moments, despite the book's many warnings to the contrary, when *Against the Gods* seems to treat it as just that. Most striking in this regard is Bernstein's discussion of the idea of regression to the mean. In its simplest, most powerful form, it simply points out that contrary to the imaginations of newspaper readers and editors everywhere, straight-line extrapolations of current trends, for example, do not continue for ever. In the classic

nineteenth-century experiment, the offspring of abnormally large peas tended to fall back towards the mean; the same is true of height in humans, and any number of other things including, as Bernstein details with an experienced hand, the stock market.

But the "law" of regression to the mean is not a law in the same sense as the law of gravity. The law, in this case, is a statement of empirical experience across a wide variety of causally unrelated settings. In the case of the size of living things, first biology and eventually physics ensure that, for example, ants can never become as large as tanks. In the case of the stock market, it is something else entirely - something else that has never been satisfactorily explained on its own terms, and yet whose existence will unquestionably be underlined nastily to investors in today's Wall Street bull market (but when?).

The law of regression to the mean encapsulates what empirical experience tells us, but, of course, it does not tap, so to speak, some strange universal force of its own. The bell curve has no independent power. Perhaps even more important, regression to the mean is meaningful only when there is a "mean" towards which to regress. Dependence on reversion to the mean for forecasting the future, Bernstein powerfully notes (in a rare departure from financial to ecological risk), tends to be perilous when the mean itself is in flux If global warming indeed lies ahead, a long string of hot years will not necessarily be followed by a long string of cold years If humans succeed in destroying the environment, floods may fail to follow droughts.

Lillian Chew's *Managing Derivative Risks: The use and abuse of leverage takes up where Against the Gods leaves off*, with the special, new categories of financial instruments known as "derivatives". Chew, the former Editor of the derivatives trade magazine *Risk*, writes with great clarity and describes these highly technical instruments without recourse to differential equations. This book ought to be read by many business people and regulators who need to know about the world of options, futures, forwards, swaps, collars, floors and a hundred more specialized products.

Derivatives are financial instruments whose value derives from the value of something else. An option to purchase stock, for example, is a derivative instrument, because the value of the option depends in the first place on the value of the stock the option entitles one to buy. But the underlying property can be literally anything; indices of stocks such as the Standard and Poor's 500, or selected commodities. The fundamental function of derivatives is Bernstein's classic problem: risk management. These instruments enable parties to shift risks from one to another, ideally matching risks to parties in ways that reduce risk in the system overall. The instruments seem esoteric, and the risks they hedge may seem equally esoteric - currency-rate risk and interest-rate risk are the most ordinary. But it bears recalling that Freddie Laker's airline went bust, not because it wasn't operationally profitable, but because at a time when the dollar was very strong against the pound, Laker Airlines had large obligations to pay for aircraft (themselves ordered to meet extraordinary demand) in strong dollars, but was earning principally in weak sterling. Moreover, derivatives enable these hedging strategies to be carried out with great cost efficiency; Chew cites a Harvard Business School academic, Robert Merton:

Some see the extraordinary growth in derivative securities . . . as only a fad However, a more likely explanation for the enormous increase in volume is the vast savings in transaction costs from their use. The costs of implementing . . . derivatives can be a tenth to a twentieth the cost of using the underlying cash-market securities With such cost savings, we are not going back: derivatives are a permanent part of the mainstream global financial system.

Derivatives come in two fundamental varieties (at least at this moment in financial history), forward-based derivatives and option-based derivatives. A forward contract "enables its buyer to lock in today the future price of an asset, be it a currency, an interest rate, an equity, or a commodity" - or the harvests of antiquity. As a hedging device, the purchaser gives up the possibility that prices in the future will go up in order to avoid the risk that they might fall; the forward reduces variance in both directions, up and down. Forward-based derivatives include the so-called "swap" contract, "an agreement between two parties to exchange (two different types of) cashflows throughout the life of the contract - in effect, a series of forwards". The most common forms are interest-rate swaps, in which a party with an existing obligation to make fixed interest payments swaps that obligation with a party with an existing obligation to make floating-rate payments, and currency swaps, in which the parties swap their existing obligations on particular currencies. The hedging function of such swaps enables the parties to diversify their risks and so reduce risk overall in the system.

The swap is a species of forward, in part because the "contract is binding on both parties: they are both obliged to exchange the cashflows whether or not the contract is to their advantage". By contrast, the second fundamental variety of derivative is based on the option, which gives the holder the right to buy or sell something at a fixed price at some point in the future. Unlike the forward, the option holder has the right, but not the obligation, to exercise the right and so buy or sell the underlying property. The option thereby gives the option-holder an asymmetrical relationship to gain and loss; the loss is limited to the purchase price of the option, while the gain is potentially unlimited depending on price movements of the underlying asset during the period of the option. The timing and asymmetry give rise to difficult problems of valuation, which were not effectively solved until the Black-Scholes option pricing model of the 1970s, and computers and calculators powerful enough to make solutions readily available in the markets. At that point, in combination with an explosion of business risks in need of hedging (ranging from international currency swings to wild interest rate fluctuations to commodity price shifts, especially in oil) option-based hedging in virtually any asset came into its own.

Much of the controversy generated by derivatives in the past several years has arisen because they were used deliberately to increase the size of bets, and in ways that were - perhaps - not properly understood by the people ultimately left holding the bag. This is what the Barings or the Orange County, California, collapses were all about. In addition, regulators of the financial payment system as a whole must consider the (controversial) hypothesis that the failure of some particular, large transaction, and then its counterparties, will cause a ripple of failures finally bringing down the payments system.

Disputes typically go to litigation over whether the financial engineers in the banking firms misstated the risks of the instruments to their clients, or whether, alternatively, the corporate-finance departments of large corporations had decided that their corporate mission was not to hedge the corporation's underlying business risks but instead attempt to be a corporate profit centre through financial speculation. Still, complex instruments are not needed to take large risks in the financial markets; the 1992 showdown between the Bank of England and George Soros over Britain's place in the EMU was conducted with simple instruments, because it was a naked bet on each side over who would blink first.

Given the mobility of international capital, derivatives will mutate from form to form; they are not going to go away. Some imagine, for example, that completing the project of European currency union will eliminate whole genres of derivatives, but this is largely a pipe dream. Certain forms of currency derivatives may disappear, certain currency exchanges may be in trouble, but given disparities between national economies, underlying business risks that are now captured in exchange-rate differentials will emerge in some other market form, and new derivatives will therefore emerge to hedge, or speculate, on them.

Chew's fundamental point is that derivatives' cost efficiencies in hedging risks are by definition "leverage" - a small amount of capital commanding a large position. But leverage is always a two-edged sword: it can be used equally to hedge and reduce risks, or to speculate and deliberately increase them. She is reasonably agnostic (as am I, and as Bernstein's observations on risk-taking perhaps suggest one ought to be) on whether financial speculation is intrinsically good or bad in the aggregate. But she is adamant, and this is what makes her book so valuable, that everyone needs to know who is hedging and who is speculating, and with whose money. Nothing, after all, is more gratifying than to bet for one's own account with other people's money. Derivatives make it highly possible to obscure all that.