How the Finance Gurus Get Risk All Wrong

BRAINSTORM ■ By Benoit Mandelbrot and Nassim Nicholas Taleb

Your money is at risk. No matter what you've put it in—stocks, bonds, derivatives, hedge funds, houses, annuities, even mattresses—there's always the chance that you could lose it or miss out on a bigger opportunity somewhere else. Anyone who would tell you otherwise is either a fool or a huckster. Then there are those who do warn of risk but package it into a simple numerical measure that seems to put it within manageable bounds. They're even more dangerous.

Your mutual fund's annual report, for example, may contain a measure of risk (usually something called beta). It would indeed be useful to know just how risky your fund is, but this number won't tell you. Nor will any of the other quantities spewed out by the pseudoscience of finance: standard deviation, the Sharpe ratio, variance, correlation, alpha, value at risk, even the Black-Scholes option-pricing model.

The problem with all these measures is that they are built upon the statistical device known as the bell curve. This means they disregard big market moves: They focus on the grass and miss out on the (gigantic) trees. Rare and unpredictably large deviations like the collapse of Enron's stock price in 2001 or the spectacular rise of Cisco's in the 1990s have a dramatic impact on long-term returns—but "risk" and "variance" disregard them.

The professors who live by the bell curve adopted it for mathematical convenience, not realism. It asserts that when you measure the world, the numbers that result hover around the mediocre; big departures from the mean are so rare that their effect is negligible. This focus on averages works well with everyday physical variables such as height and weight, but not when it comes to finance. One can disregard the odds of a person's being miles tall or tons heavy, but similarly excessive observations can never be ruled out in economic life. The German mark's move from four per dollar to four trillion per dollar after World War I should have taught economists to beware the bell curve.

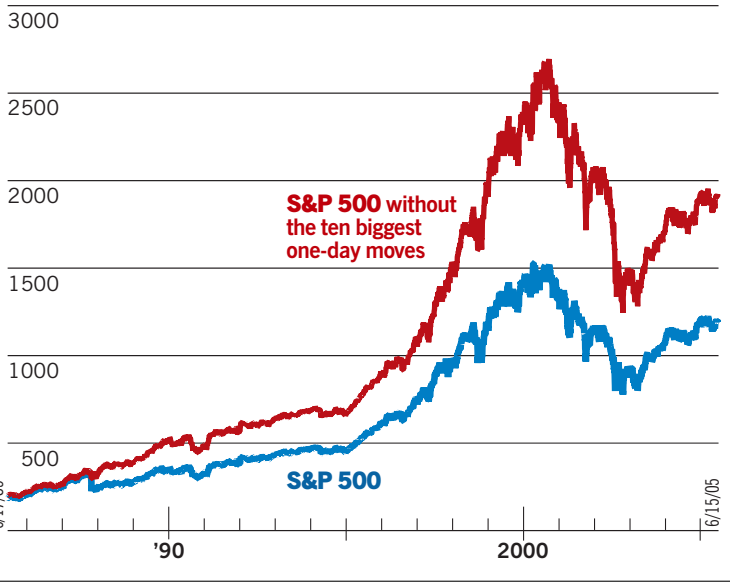
Today Google grabs much Internet traffic, and Microsoft represents the bulk of PC software sales. Out of a million submitted manuscripts, a handful account for the bulk of book sales. One percent of the U.S. population earns close to 90 times what the bottom 20% does, and half the capitalization of the stock market (close to 10,000 companies) is in fewer than 100 corporations.

In other words, we live in a world of winner-take-all extreme concentration. Similarly, a very small number of days accounts for the bulk of stock market movements: Just ten trading days can represent half the returns of a decade.

The economic world is driven primarily by random jumps. Yet the common tools of finance were designed for random walks in which the market always moves in baby steps. Despite increasing empirical evidence that concentration and jumps better characterize market reality, the reliance on the random walk, the bell-shaped curve, and

A Lot Can Happen in Ten Days

Conventional finance theory treats big one-day market jumps or drops as anomalies that can be safely ignored when gauging risk or forecasting returns. But if you remove the ten biggest one-day moves (both up and down) from a chart of the S&P 500 over the past 20 years, you get a picture very different from market reality. The big moves matter.



FORTUNE CHART

GREGORY SAMS—PHOTO RESEARCHERS

Fractal geometry of the sort used to generate these imaginary mountains can also model financial-market risk.

their spawn of alphas and betas is accelerating, widening a tragic gap between reality and the standard tools of financial measurement.

It was in the third century of our era that the skeptical philosopher and physician Sextus attacked blind reliance on dogmas; his stance earned him the name Sextus Empiricus (Sextus the Empirical). Depressingly, medicine took 13 centuries to follow his recommendations, become empirical, and integrate surgeons' observations of the human body. The same has been happening in finance. The inapplicability of the bell curve has long been established, yet close to 100,000 MBA students a year in the U.S. alone are taught to use it to understand financial markets. For those who teach finance, a number seems better than no number—even if it's wrong.

To blow up an academic dogma, empirical observations do not suffice. A better theory is needed, and one exists: the fractal theory of risk, ruin, and return. In this approach, concentration and random jumps are not belated fudges but the point of departure. The term "fractal" was coined in the 1970s by one of the authors of this piece to describe the many phenomena of nature in which small parts resemble the whole: The veins in leaves look like branches; branches look like miniature trees; rocks look like miniature mountains.

Similar patterns can be found in economic data, and the parts often relate to the whole according to what's called a power law. Such a law was first found to apply to the distribution of wealth: If there are about one-fourth as many people with a net worth of more than $200 million as there are with a net worth of more than $100 million, then there will also be about one-fourth as many with $2 billion as with $1 billion. This key property makes the computations easy; no computer is needed to divide by four.

In market terms, a power-law distribution implies that the likelihood of a daily or weekly drop exceeding 20% can be predicted from the frequency of drops exceeding 10%, and that the same ratio applies to a 10% vs. a 5% drop. In bell-curve finance, the chance of big drops is vanishingly small and is thus ignored. The 1987 stock market crash was, according to such models, something that could happen only once in several billion billion years. In power-law finance, big drops—while certainly less likely than small ones—remain a real and calculable possibility.

Another aspect of the real world tackled by fractal finance is that markets keep the memory of past moves, particularly of volatile days, and act according to such memory. Volatility breeds volatility; it comes in clusters and lumps. This is not an impossibly difficult or obscure framework for understanding markets. In fact, it accords better with intuition and observed reality than the bell-curve finance that still dominates the discourse of both academics and many market players.

> "Diversify as broadly as you can—far more than the **supposed experts** tell you."

Fractal finance, alas, has not yet earned a place in the MBA curriculum. Until that happy day, what is a person with money at stake to do? First, diversify as broadly as you can—far more than the supposed experts tell you now. This isn't just a matter of avoiding losses: Long-run market returns are dominated by a small number of investments, hence the risk of missing them must be mitigated by investing as broadly as possible. Passive indexing is far more effective than active selection—but you need to go well beyond an S&P 500 fund to do yourself much good. And wherever you put your money, understand that conventional measures of risk severely underestimate potential losses—and gains. For better or worse, your exposure is larger than you think. F

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