no debt finance, which our current tax laws favor because interest (but not dividends) is a tax-deductible expense. In such a circumstance, the shares of the company are properly worth a premium price to shareowners who can change the current managers and their nonoptimal financial policies. The poorly run company was not previously being undervalued by investors, if they had no way to change the company's management. I too worry that the leveraged buyout wave may get carried too far, with several bankruptcies resulting, if we experience another serious recession. But the fault lies with government tax policy, which makes companies more valuable the more they employ debt rather than equity finance.

Bechhoefer points out quite correctly that some of the most relevant financial information about a company's future prospects is only dimly perceived. It is for that reason that professional security analysts do exactly what Bechhoefer suggests: They ask what suppliers and customers think of the company; they try to judge how good the company's products are relative to those of its competitors; and they do try to size up company management. But this subjective information also gets reflected in market prices. "Good" companies sell at higher prices. For this reason, an ability to interpret all important subjective information correctly is no guarantee of investment success.

Are there some consistently superior investment managers, or are those who outperform "just plain lucky"? I would not deny that there exist a small handful of managers who have outperformed the market, and there may well be a few investment geniuses around. But even those with good long-term records are not perfectly consistent, and the number of outliers we find are not more than would be expected by chance.

Randomness is a difficult notion for people to accept. When events come in clusters and streaks, people look for explanations and patterns. They refuse to believe that such patterns—which frequently occur in random data—could equally well be derived from tossing a coin. So it is in the stock market as well.

BURTON G. MALKIEL
*Department of Economics,
Princeton University, Princeton, NJ 08544*

Solar System Chaos

We have no quarrel with Richard A. Kerr's statement (Research News, 14 Apr., p. 144) that, as faster computers have allowed longer numerical integrations, chaos is turning up everywhere in the solar system. However, the true meaning of this chaos is not yet understood. Nor is it clear how relevant it is in shaping the present configuration of our solar system; certainly chaos is not a deus ex machina capable of explaining the entire distribution of objects in the solar system.

In a few cases the results on chaos in the solar system do explain observations. For example, chaos is thought to produce the gap in the distribution of asteroids at the 3:1 orbital resonance with Jupiter by inducing highly eccentric orbits (*1*), in one case even elongated enough to cross Earth's path, thereby indicating a route for the delivery of meteorites (*2*). Close encounters with Jupiter resulting from chaos also appear to be the explanation for the drop of asteroid number density in the outer belt (*3*). Finally, the clearest example concerns Hyperion, the hamburger-shaped Saturnian satellite that is locked in orbital resonance with neighboring massive Titan inside a small libration island surrounded by a large chaotic region (*4*). It appears that, as the satellite was battered by primordial impacts, chaos prevented fragments from being reaccreted. Consequently, only Hyperion's craggy core remains today (*5*), and its very irregular shape—together with the large eccentricity forced by Titan—is responsible for the satellite's chaotic tumbling (*6*). From orbital chaos, spin chaos was born!

The presence of chaos, however, does not necessarily imply that real objects are invariably absent. Project SPACEGUARD (*7*), which investigated all known planet-crossing asteroids as influenced by all planets but Mercury and Pluto, shows that, over the 200,000-year span of the calculation, asteroid motions are highly chaotic; yet the objects are there. Moreover, chaos can mean quite different things: asteroids can be perturbed onto comet-like paths or have their eccentricities pumped up to Earth-crossing values while in orbital resonances with Jupiter, but they can also be protected from close planetary approaches.

As Kerr describes, even planetary orbits are now seen to be chaotic with the time scales for the onset of chaos being remarkably brief: 5 million years for the inner planets and 20 million years for Pluto. This chaos has startled celestial mechanicians who, for over two centuries, have been trying to prove just the opposite, namely that the solar system is stable, perhaps motivated by the simple fact that we are here. However, N-body systems with $N > 2$ are nonintegrable, and the phase spaces of such systems are known to contain an intricate interweaving of regular and chaotic regions. Although the planets have only feeble mutual perturbations, chaotic regions must exist so that, provided a numerical integration is long enough, the solution will enter such a region. In this context, planetary chaos was in fact foreseen by Poincaré, but many today have forgotten his prediction. Nevertheless, the implications of planetary chaos are not so clear-cut as in the asteroid examples cited above. In those cases chaos determines the dynamics by forcing the asteroids close to the planets, as happened when 1989FC passed Earth in late March at only twice the moon's distance. But the planets have been around for nearly 1000 times the detected time scale for chaos in the inner planets, so in this case what does chaos mean? For Pluto, an analysis motivated by the discovery of chaos (*8*) shows that the planet's major dynamical features are unchanged despite the strength of the chaos (*9*). It is important to note that different long-term integrations of the orbits of the outer planets do generally agree, thereby implicitly validating both works. However, they also demonstrate that the role of high-order secular resonances, as well as the strength of the chaos—and possibly its very detection—depend strongly on initial conditions and the physical model used.

The curious situation today is that, as our capability to detect chaos in the motion of real objects increases, the relevance of this chaos becomes more difficult to assess.

ANNA M. NOBILI*
*Department of Astronomy,
Space Sciences Building,
Cornell University,
Ithaca, NY 14853*
JOSEPH A. BURNS
Departments of Astronomy and
*Theoretical and Applied Mechanics,
Cornell University*

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*On sabbatical leave from the University of Pisa, Pisa, Italy, with the support of the G. Colombo fellowship of the European Space Agency.

Erratum: The article "Japan faces big task in improving basic science" (News & Comment, 10 Mar., p. 1285) by Marjorie Sun stated (p. 1286) that Japan's Ministry of Education, Science, and Culture, known as Monbusho, "has only a few peer review committees." In fact, Monbusho has a few committees in each scientific specialty, such as molecular biology.