# Letters

## The Efficient Market Hypothesis

Burton G. Malkiel's conclusion (Articles, 10 Mar., p. 1313) that the stock market accurately and efficiently determines corporate values, if true, is outdated. This conclusion may have been valid 20 or 30 years ago, when the stock markets were dominated by individual investors who were interested in long-term dividend flows. A number of important changes have taken place since then that Malkiel does not take into account.

The market is now dominated by institutional investors who are primarily interested in short-term gains. They are, in a word, concerned with what the stock will be selling for next Thursday, not how much the company can be expected to earn in the next 10 or 15 years. They hedge their bets with stock index futures and program trading, neither of which existed 30 years ago.

Foreign currency values, interest rates, and commodity prices are much more volatile than they used to be. Financial transactions that used to take days to perform with paper can now be done electronically with the speed of light. With the global integration of the world economy, the incomes and values of U.S. corporations can increasingly depend on events that occur abroad, which we can neither predict nor control. The market that Malkiel is describing and modeling simply no longer exists.

If the stock markets were efficient at determining corporate values, then it would be impossible to explain the current wave of leveraged buyouts and hostile takeovers. The investment bankers who are engineering these deals say that the deals are viable precisely because these companies have been undervalued by the stock market by as much as a factor of 2.

One cannot have it both ways. Either the investment bankers are right and these stocks have been greatly undervalued by an inefficient stock market, or else the stock market is right and has correctly valued these companies. In the latter case, these deals will all eventually lead to bankruptcy court when the cash flow proves inadequate to service the debt on the high-yield "junk" bonds issued to effect the buyout. The experiment, in fact, has already been started. We are all eagerly awaiting the result.

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Malkiel's persuasive article in support of the efficient market hypothesis leaves out a number of points that might argue to the contrary. The notion that "all information that is known by any market participant is fully reflected in market prices," as Malkiel states, suggests not *how much* an investor knows, but rather *how little*. While the market may be efficient, information available to the average investor (including even the average portfolio manager) is usually insufficient for making well-informed decisions.

Common information sources for individual companies are readily available to most investors. Data on interest rates, world catastrophes, foreign market movements, inflation, employment, and a host of other factors are also so widely available that it would be surprising if the average investor outperformed the market averages. That the average investor does not is only one more example of a decision-making process that Simon aptly calls "satisficing" (*1*). You do the best you can with the information at hand.

For mutual fund portfolios, moreover, securities law places limits on the amount of stock the fund can hold in any one company. Other large portfolios may also be subject to such limitations. A prudent manager will minimize risk by not putting all the eggs into one basket. The greater the number of companies in a portfolio, the more likely its performance will begin to approximate the overall market averages.

Most arguments for the efficient market hypothesis are based on studies of investment decisions of large portfolio managers, not individual or smaller investors. A free market by definition requires numerous buyers and sellers, such that no single transaction by itself affects market price. This necessary condition is often violated when a portfolio manager executes a major transaction worth several million dollars. A sale of that magnitude invariably *does* make a difference—enough to cause the price movement of a security to become a self-fulfilling prophecy of the major traders. In effect, they are the market.

Are those who consistently outperform the market just plain lucky? Or are there reasons why some large portfolio managers can produce better than 20% increases in asset values every year? I believe this success comes from paying great attention to the subjective measures of company performance: How good is the product? How well do the managers treat employees and shareholders? What do suppliers and customers think about the company? How sensitive is the company to changes in the marketplace? In this world of imperfect information, facts and our perceptions of them are open to question. Investors who consistently succeed probably know the difference between good management and good luck.

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*Response*: Yaes makes the correct point that the stock market has become highly institutionalized during the past 20 years. Institutional investors regularly account for more than 80% of the trading volume on the New York Stock Exchange. But most observers have argued that institutionalization does not make the market less efficient. On the contrary, the research capability of institutions and their ability to monitor news as it happens and react quickly makes the market more responsive to information flows and thus *more* efficient. If these institutions do not care "how much a company can be expected to earn in the next 10 or 15 years," how can Yaes explain why a nondividend-paying stock in an exciting growth industry such as Lin Broadcasting sells at a price-earnings multiple of 60, while the multiple for the market as a whole is below 15?

It is true that institutional investors now regularly use futures contracts as part of their investment strategy. But this results in significant part because of an acceptance of efficient-market precepts. Today literally hundreds of billions of dollars are invested in "index funds," that is, simply invested and held in an account that mirrors one of the broad market indexes such as the Standard and Poor's 500-Stock Index. The pension fund CREF is so invested. This strategy is popular because more and more professionals have realized how efficient the market is and how difficult it is to obtain superior investment performance. Futures contracts are regularly used by index funds to invest quickly large inflows of new funds and to provide liquidity and portfolio hedges. Neither the futures market nor the globalization of securities markets is in any way inconsistent with market efficiency.

Is the large premium often paid for companies in leveraged buyouts and hostile takeovers inconsistent with market efficiency? Not at all. There is a difference between the value of a small investment position in a company and the value of a "control" position. Suppose a company was not being well managed—suppose it squandered its cash flow on projects that aggrandized its managers rather than its shareowners and it used

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.

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## 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.

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*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.