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The Efficient-Market Hypothesis and the Financial Crisis

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Abstract

The world-wide financial crisis of 2008-2009 has left in its wake severely damaged economies in the United States and Europe. The crisis has also shaken the foundations of modern-day financial theory, which rested on the proposition that our financial markets were basically efficient. Critics have even suggested that the efficient--market–hypotheses (EMH) was in large part, responsible for the crises.

This paper argues that the critics of EMH are using a far too restrictive interpretation of what EMH means. EMH does not imply that asset prices are always "correct." Prices are always wrong, but no one knows for sure if they are too high or too low. EMH does not imply that bubbles in asset prices are impossible nor does it deny that environmental and behavioral factors cannot have profound influences on required rates of return and risk premiums. At its core, EMH implies that arbitrage opportunities for riskless gains do not exist in an

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efficiently functioning market and if they do appear from time to time that they do not persist. The evidence is clear that this version of EMH is strongly supported by the data. EMH can comfortably coexist with behavior finance, and the insights of Hyman Minsky are particularly relevant in eliminating the recent financial crisis.

Bubbles, when they do exist are particularly dangerous when they are financed with debt. And the housing bubble and its associated derivative securities left both the consumer and financial sectors dangerously leveraged. Policy makers are unlikely to be able to identify bubbles in advance, but they must be better focused on asset-price increases that are financed with debt.

Introduction

The world-wide financial crisis of 2008-2009 has left in its wake severely damaged economies in the United States and Europe. Unemployment rates soared up to and in some cases above the double digit level, and economies in Europe and the U.S. are still operating well below economic capacity. Moreover, the high indebtedness of consumers, financial institutions, and governments has made the severe recession unusually persistent and has limited the fiscal policy responses of governments throughout the world.

The crisis has also shaken the very foundations of modern-day financial theory, which rested on the hypothesis that our financial markets were basically efficient. Financial writers and economists alike were ready to write obituaries for the "efficient market hypothesis," or "EMH" as it was widely known. The financial writer Justin Fox published a bestselling book in 2010 entitled *The Myth of the Rational Market*. The economist Robert Shiller described EMH as "the most remarkable error in the history of economic thought." Some professional investment managers went even further. Jeremy Grantham opined that EMH was "more or less directly responsible" for the financial crisis. Paul Krugman (2009)

agreed, writing that "the belief in efficient financial markets blinded many if not most economists to the emergence of the biggest financial bubble in history. And efficient-market theory also played a role in inflating that bubble in the first place."

In this essay I describe what the efficient market hypothesis implies for the functioning of our financial markets. I suggest that a number of common misconceptions about EMH have led some analysts to reject the hypothesis prematurely. I then examine the abundant evidence that leads me to believe that our financial markets are remarkably efficient and that reports of death of EMH are greatly exaggerated. Finally, I indicate what I believe are the important lessons policy makers should learn from the financial crisis.

What EMH Means and What It Doesn't Mean

Two fundamental tenets make up the Efficient Market Hypothesis. EMH first asserts that public information gets reflected in asset prices without delay. Information that should beneficially (adversely) affect the future price of any

financial instrument will be reflected in the asset's price today. If a pharmaceutical company now selling at $20 per share receives approval for a new drug that will give the company a value of $40 tomorrow, the price will move to $40 right away, not slowly over time. Because any purchase of the stock at a price below $40 will yield an immediate profit, we can expect market participants to bid the price up to $40 without delay.

It is, of course, possible that the full effect of the new information is not immediately obvious to market participants. It is also likely that the estimated sales and profits cannot be predicted with any precision and that the value of the discovery is amenable to a wide variety of estimates. Some market participants may vastly underestimate the significance of the newly approved drug but others may greatly overestimate its value. Therefore, in some cases, the market may underreact to a favorable piece of news. But in other cases, the market might overreact, and it is far from clear that systematic underreaction or overreaction to news presents an arbitrage opportunity promising traders easy, risk-adjusted, extraordinary gains. It is this aspect of EMH that implies a second, and more

fundamental, tenet of the hypothesis: In an efficient market, no arbitrage opportunities exist.

This lack of opportunities for extraordinary profits is often explained by a joke popular with professors of finance. A professor who espouses EMH is walking along the street with a graduate student. The student spots a $100 bill lying on the ground and stoops to pick it up. "Don't bother to try to pick it up," says the professor. "If it was really a $100 bill it wouldn't be there." Perhaps a less extreme telling of the story would have the professor telling the student to pick the bill up right away because it will not be lying around very long. In an efficient market, competition will ensure that opportunities for extraordinary risk-adjusted gain will not persist.

EMH does not imply that prices will always be "correct" or that all market participants are always rational. There is abundant evidence that many (perhaps even most) market participants are far from rational and suffer from systematic biases in their processing of information and their trading proclivities. But even if price setting was always determined by rational profit-maximizing investors, prices can never be "correct." Suppose that stock prices are rationally

determined as the discounted present value of all future cash flows. Future cash flows can only be estimated and are never known with certainty. There will always be errors in the forecasts of future sales and earnings. Moreover, equity risk premiums are unlikely to be stable over time. Prices are therefore likely to be "wrong" all the time. What EMH implies is that we never can be sure whether they are too high or too low at any given time. Some portfolio managers may correctly determine when some prices are too high and others too low. But other times such judgments will be in error. And, in any event, the profits that will be attributable to correct judgments will not represent unexploited arbitrage possibilities.

Complex financial investments are particularly susceptible to mispricing, especially when the loans that underlie the derivative are misrepresented. And while a full discussion of the causes of the financial crisis is beyond the scope of this paper, there is no doubt that mispricing of mortgage-backed securities played an important role in widening the crisis. While the mispricing of the real estate securing the mortgages may correctly be described as a classic bubble, there was far from a lack of rationality throughout the market. Perverse incentives

influenced both mortgage originators and investment bankers. And the financial institutions that held excessive amounts of the toxic instruments in highly leveraged portfolios were encouraged to do so by asymmetric compensation policies and by a breakdown of regulation that failed to constrain excessive debt and inadequate liquidity. In any event, while some hedge funds profited from selling some of these instruments short, there were certainly no arbitrage opportunities that were obvious ex ante.

EMH and the Adjustment of Market Prices to Different Types of New Information

It has been customary, since Eugene Fama's (1970) influential survey article, to distinguish three versions of EMH depending on the type of information that is believed to be reflected in the current prices of financial assets. In the "narrow" or "weak" form of the hypothesis, it is asserted that any information that might be contained in historical price series or trading volume is already reflected in current prices. Since past trading data are widely available, any historical patterns that might have reliably predicted future price movements will

already have been exploited. If, for example, there has been a reliable "Santa Claus Rally" (suggesting the stock prices will rise between Christmas and New Year's Day), investors will act to anticipate the signal, and by so doing, the historical pattern will self-destruct. According to this version of EMH, "technical analysis" – the interpretation of historical price charts – will be nugatory.

Broader forms of the hypothesis expanded on the types of information that will be reflected in current prices. According to the "semi-strong" form of the hypothesis, any "fundamental" information about individual companies or about the stock market as a whole will be reflected in stock prices without delay. Thus, investors cannot profit from acting on some favorable piece of news concerning a company's sales, earnings, dividends, etc., because all publicity available will have already been reflected in the company's stock price. Profit-seeking traders and investors can be expected to exploit even the smallest informational advantage, and by so doing, they incorporate all information into market prices, thereby eliminating any profit opportunities. According to this version of the hypothesis, even "fundamental analysis," the type of in-depth analysis of the financial

situation and the prospects for individual companies, will prove fruitless because all favorable information will already have been reflected in market prices.

A third form of EMH hypothesis suggests that not only anything that is known, but also anything that is knowable, has already been assimilated into market prices. This extreme version postulates that one cannot even benefit from "inside information." It is unlikely that this "strong form" of the hypothesis is ever completely satisfied. But trading on "inside information" is illegal, and the Securities and Exchange Commission in the United States has been increasingly diligent in going after company executives and hedge fund managers who are believed to have profited from trading on inside information.

EMH and the Random Walk Hypothesis

All forms of EMH imply that market prices cannot be forecast. Much of the empirical literature has focused on the random walk hypothesis, a statistical description of unforecastable price changes. The term was apparently first used in an exchange of correspondence that appeared in *Nature* (1905) in the early 1900s. The subject of the correspondence was the optimal search procedure for

finding a drunk who had been left in the middle of a field. The answer was quite complex, but the place to start was simply the place where the drunkard had been left. Paul Samuelson (1965) made a seminal contribution to the EMH literature in his article entitled "Proof that Properly Anticipated Prices Fluctuate Randomly." If market prices fully incorporate the information and expectations of all market participants, then price changes must be random. Prices will, of course, change as new information is revealed to the market, but true news is random — it cannot be forecast from past events. Thus, in an informationally efficient market, price changes are unforecastable. Samuelson's contribution has been extended to allow for risk averse investors by LeRoy (1973) and Lucas (1978) and in many other directions by other researchers including allowing for heterogeneous expectations. Random price movements do not imply that the stock market is capricious. Randomness indicates a well-functioning and efficient market rather than an irrational one.

The earliest empirical work on the random walk hypothesis was performed by Bachelier (1900). He concluded that commodities prices followed a random walk, although he did not use that term. Corroborating evidence from other time

series was provided by Working (1934) and from U.S. stock prices by Cowles and Jones (1937) and Kendall (1953). These studies generally found that the serial correlations between successive changes were essentially zero. Roberts (1959) found that a time series generated from a sequence of random numbers had the same appearance as a time series of U.S. stock prices. Osborne (1959) concluded that stock price movements were similar to the random Brownian motion of physical particles and that the logarithms of price changes were independent of each other.

Other empirical work has used alternative techniques and data sets and has searched for more complicated patterns in the sequence of prices in speculative markets. Granger and Morgenstern (1963) used the technique of spectral analysis but were unable to find any dependably repeatable patterns in stock price movements. Fama (1965a, 1965b) not only looked at serial correlation coefficients (which were close to zero) but also corroborated his investigation by examining a series of lagged prices and by performing a number of nonparametric "runs" tests. He also examined a variety of filter techniques—trading techniques where buy (sell) signals are generated by some upward (downward) price

movements from recent troughs (peaks) —and found they could not produce abnormal profits. Other investigations have done computer simulations of more complicated technical analysis of supposedly predictive stock chart patterns (such as “double tops,” “inverted head and shoulders,” etc.) and have found that profitable trading strategies could not be undertaken on the basis of these patterns. Solnik (1973) measured serial correlation coefficients for daily, weekly, and monthly price changes in nine countries and concluded that profitable investment strategies could not be formulated on the basis of the extremely small dependencies found.

Although most of the earliest studies of the stock market supported a general finding of randomness, more recent work indicated that the random walk model does not strictly hold. Some patterns appear to exist in the development of stock prices. Over short holding periods, there is some evidence of momentum in the stock market, while for longer holding periods, mean reversion appears to be present. Nevertheless, it is less clear that violations exist of the weak form of EMH, which states only that unexploited trading opportunities should not persist in any efficient market.

Lo and MacKinlay (1999), in a book entitled *A Non-Random Walk Down Wall Street*, have found evidence inconsistent with the random walk model. Calculating weekly and monthly holding period returns for various stock indexes, they find evidence of positive serial correlation, implying that there is some momentum in stock prices. Moreover, exploiting the fact that return variances scale linearly in a random walk (RW) market, they construct a variance ratio test that rejects the RW hypothesis. This rejection of the RW hypothesis for stock indexes may result, however, from the behavior of small company stocks that are infrequently traded. New information about the market as a whole is likely to get factored into the prices of large capitalization stocks first and then into smaller stocks later. Interestingly, Lo and MacKinlay are unable to reject the RW hypothesis when tests are performed on individual stocks. Jegadeesh and Titman (1993) have also found some evidence of momentum in stock prices.

Two possible explanations for the existence of momentum have been offered: the first is based on behavioral considerations, the second on sluggish responses to new information. Shiller (2000) emphasized a psychological feedback mechanism imparting a degree of momentum into stock prices,

especially during periods of extreme enthusiasm. Individuals see stock prices rising and are drawn into the market in a kind of "bandwagon effect." The second explanation is based on the argument that investors do not adjust their expectations immediately when news arises — especially news of company earnings that exceeded (or fell short of) anticipations. Ball and Brown (1968) and Rendleman**,** Jones, and Latané (1982) found that abnormally high returns follow positive earnings surprises as market prices appear to respond to earnings information only gradually.

There is enough evidence in support of short-term momentum that researchers such as Carhart (1997) have considered momentum to be a priced factor in explaining the cross-section of security and mutual fund returns. And Asness et.al (2010) have offered actual investment funds where stocks showing positive momentum are overweighted in the portfolio. In these two analyses, positive momentum is considered to be strong relative performance over the preceding twelve months (not including the most recent month to allow for any short-term return reversals). As is the case with many of the so-called predictable patterns in stock-price returns, investment strategies based on these are

predictive during some periods but not in others.

While there is some evidence supporting the existence of short-term momentum in the stock market, many studies have shown evidence of negative serial correlation — that is, return reversals — over longer holding periods. For example, Fama and French (1988) found that 25 to 40 percent of the variation in long holding period returns can be predicted in terms of a negative correlation with past returns. Similarly, Poterba and Summers (1988) found substantial mean reversion in stock market returns at longer horizons.

Some studies have attributed this forecastability to the tendency of stock market prices to "overreact." DeBondt and Thaler (1985), for example, argue that investors are subject to waves of optimism and pessimism that cause prices to deviate systematically from their fundamental values and later to exhibit mean reversion. They suggest that such overreaction to past events is consistent with the behavioral decision theory of Kahneman and Tversky (1974, 1979), where investors are systematically overconfident of their ability to forecast either future

stock prices or future corporate earnings.[1] These findings give some support to investment techniques that rest on a "contrarian" strategy, that is, buying the stocks, or groups of stocks, that have been out of favor for long periods of time.

However, the finding of mean reversion is not uniform across studies and is quite a bit weaker in some periods than it is for others. Indeed, the strongest empirical results come from periods including the Great Depression, which may be a time with patterns that do not generalize well. Moreover, such return reversals for the market as a whole may be quite consistent with the efficient functioning of the market since they could result, in part, from the volatility of interest rates and the tendency of interest rates to be mean reverting. Since stock returns must rise or fall to be competitive with bond returns, there is a tendency when interest rates go up for prices of both bonds and stocks to go down, and as interest rates go down for prices of bonds and stocks to go up. If interest rates revert to the mean over time, this pattern will tend to generate return reversals, or mean reversion, in a way that is quite consistent with the efficient functioning

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*See also Kahnaman and Rupe (1998).

of markets.

Moreover, it may not be possible to profit from the tendency for individual stocks to exhibit return reversals. Fluck, Malkiel, and Quandt (1997) simulated a strategy of buying stocks over a I3-year period during the I980s and early 1990s that had particularly poor returns over the past three to five years. They found that stocks with very low returns over the past three to five years had higher returns in the next period and that stocks with very high returns over the past three to five years had lower returns in the next period. Thus, they confirmed the very strong *statistical* evidence of return reversals. However, they also found that returns in the next period were similar for both groups, so they could not confirm that a contrarian approach would yield higher-than-average returns. There was a statistically strong pattern of return reversal, but not one that implied an inefficiency in the market that would enable investors to make excess returns.

Moreover, many of the predictable patterns mentioned in the finance literature seemed to disappear after they were published. Schwert (2001) suggests two possible explanations. First, researchers have a normal tendency to focus on results that challenge conventional wisdom. It is likely that in some

particular sample a statistically significant result may well emerge that appears to challenge EMH. Alternatively, practitioners may learn quickly about any "dependable" profit-making opportunities and exploit them until they are no longer profitable. In other words, if there are hundred-dollar bills available, they will be picked up as soon as they are discovered. My own view of the matter has been succinctly expressed by Richard Roll (1992), an academic economist who also was a portfolio manager, investing billions of dollars of investment funds:

> I have personally tried to invest money, my client's money and my own, in every single anomaly and predictive device that academics have dreamed up.... I have attempted to exploit a whole variety of strategies supposedly documented by academic research. And I have yet to make a nickel on any of these supposed market inefficiencies.... But, I have to keep coming back to my point… that a true market inefficiency ought to be an exploitable opportunity. If there's nothing investors can exploit in a systematic way, time in and time out, then it's very hard to say that information is not being properly incorporated into stock prices.... Real money investment strategies don't produce the results that academic papers say they should.

The Semi-Strong Form of EMH

The narrow or weak form of EMH suggests that any information contained in the history of stock prices will have already been reflected in current prices.

Hence, “technical analysis,” the analysis of past price movements, cannot be employed to produce above-average returns. But most professional investment managers are “fundamental analysts” rather than technicians. Fundamental analysts study a wide range of information, including company sales, earnings, asset values, etc., in forming portfolios that they hope will earn excess returns. Studies attempting to determine whether publicly available information can be used to improve portfolio performances are tests of the semi-strong form of EMH. Usually a finding that abnormal returns can be earned is referred to as an EMH anomaly.

At the outset, it is important to note that any empirical test purporting to show that abnormal returns can be earned is based on some model of risk adjustment. For example, the capital asset pricing model (CAPM) is often used to adjust for risk. Thus, an anomalous finding that excess returns can be earned by exploiting publicly available “fundamental” information is actually a joint test of EMH and the risk adjustment procedures employed. If the CAPM beta is an inadequate measure of risk (or if beta is measured with error), it will be inappropriate to consider beta-adjusted excess returns to be inconsistent with

EMH. Similarly, if market capitalization (size) and market-to-book factors are added to beta to account for risk, abnormal returns will be identified only if this three-factor model fully describes the cross-section of expected returns.

Tests of the semi-strong form of EMH have looked at how rapidly new information is reflected in market prices and whether the use of certain valuation metrics favored by security analysts can generate abnormal returns. Studies seeking to examine the rapidity of price responses to news announcements are called event studies. The "events" used in such studies have included dividend changes, earnings reports that have differed from estimates, merger announcements, etc.

Various tests have been performed to ascertain the speed of adjustment of market prices to new information. Fama *et al.*(1969) looked at the effect of stock splits on equity prices. Although splits themselves provide no economic benefit, splits are usually accompanied or followed by dividend increases that do convey information to the market concerning management's confidence about the future progress of the enterprise. While splits usually result in higher market valuations, the market appears to adjust to such announcements fully and immediately.

Substantial returns can be earned before the split announcement, but there is no evidence of abnormal returns after the public announcement.

Similarly, merger announcements can raise market prices substantially, especially when premiums are being paid to the shareholders of the acquired firm, but it appears that the market adjusts fully to the public announcements. Dodd (1981) and Keown and Pinkerton (1981) found no evidence of abnormal price changes after the public release of merger information. Patell and Wolfson (1984) examined the intraday speed of adjustment to earnings and dividend announcements. They noted that the stock market assimilates publicly available information "very quickly." The largest portion of the price response occurs in the first 5 to 15 minutes after disclosure.

Although most event studies have supported EMH, some have not. Ball (1978) found that stock-price reactions to earnings announcements were not complete. He found that abnormal returns could be earned in the period after the announcement date. Rendelman, Jones, and Latané (1982) also found that unexpected earnings announcements were not immediately reflected in stock prices and that abnormal returns could be earned by purchasing shares of

companies with positive earnings surprises. These studies of sluggish adjustment (or underreaction) support the momentum arguments referred to above. However, the pattern of underreaction to announcements is not consistent over time. Fama (1998) has argued that overreaction appears about as often as under-reaction to news[2] announcements. In any event, such anomalies tend to be so small that only professional traders could have earned economic profits.

There has been considerable work on the use of a variety of valuation metrics to isolate stocks that are expected to generate "excess" returns. An influential book by Graham and Dodd (1934) entitled *Security Analysis* spawned the development of a whole profession of security analysts who were trained to examine "fundamental" financial data for firms such as earnings and asset values and find stocks that represented "good value." The approach remains popular today, especially with the growing appeal of behavioral finance. Behaviorists such as Kahneman (1998) have argued that investors tend to be overoptimistic and far too certain of their forecasts than is warranted. Thus, they tend to overestimate

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[*] See also Bernard and Thomas (1990).

future growth and pay more than they should for “growth” stocks – those stocks promising above-average future growth. Conversely, so-called “value” stocks – those that are less exciting and therefore sell at more modest valuation metrics, such as low multiples of earnings and of book value – are likely to generate excess returns.

Of all the predictable patterns that have been discovered, this so-called “value effect” is one of the most supported by the evidence. Basu (1977) found that portfolios of stocks with low price-earnings (P/E) multiples have tended to provide higher returns than portfolios of stocks with high P/E ratios. Using a somewhat different value criterion, Fama and French (1992, 1998) found that portfolios made up of stocks with low ratios of price-to-book value (P/BV) provided relatively higher returns than portfolios of high P/BV firms. When the CAPM measure of risk was used to adjust for risk, the higher return from value stocks appeared to represent an inefficiency.

Another pattern that has found empirical support is the size or small-firm effect. Between 1926 and the present, an investor could have realized higher portfolio returns by concentrating on stocks with relatively small market

capitalizations.* Fama and French (1998) demonstrated that this effect can be documented in international as well as in the U.S. stock markets. In the U.S., the excess returns from small-capitalization stocks appear almost entirely in January — hence this size effect is often called "The January Effect."

Findings such as these have often been considered "anomalies" or "inefficiencies." But again we are driven back to the joint hypothesis problem. If CAPM is an insufficient model for the measurement of risk, then the result does not represent an inefficiency. Indeed, Fama and French (1993) have proposed that small company stocks and low P/BV stocks are riskier. Small companies can be more vulnerable to economic shocks than larger firms and low P/BV may be a reflection of some form of economic distress. For example, during the recent financial crisis, distressed bank stocks sold at unusually low prices relative to their book values. Hence, any excess returns that were earned were simply some compensation for risk. This interpretation has been vigorously disputed by Lakonishok, Schleifer, and Vishny (1995), who argue that these patterns are

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* See Banz (1981) and Ibbotson Associates, Annual Yearbooks.

evidence of inefficiencies. Nevertheless, it has become standard to employ risk measurement techniques that augment the "Beta" risk measure of CAPM with the addition of size and P/BV factors. In some models, a fourth factor, momentum, is added to the Fama-French three-factor risk model.*

Predictable Time-Series Market Returns Based on Valuation Parameters

Considerable empirical research has been conducted to determine if future returns for the overall market can be predicted on the basis of initial valuation parameters. It is claimed that valuation ratios, such as the price-earnings multiple or the dividend yield of the stock market as a whole, have considerable time series predictive power.

Formal statistical tests of the ability of dividend yields (that is, the ratio of dividends to stock prices) to forecast future returns have been conducted by Fama

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* See, for example, Carhart (1997).

and French (1988) and Campbell and Shiller (1988). Depending on the forecast horizon involved, as much as 40 percent of the variance of future returns for the stock market as a whole can be predicted on the basis of the initial dividend yield of the market index.

This finding is not necessarily inconsistent with efficiency. Dividend yields of stocks tend to be high when interest rates are high, and they tend to be low when interest rates are low. Consequently, the ability of initial yields to predict returns may simply reflect the adjustment of the stock market to general economic conditions. Moreover, the use of dividend yields to predict future returns has been much less effective since the mid-1980s. One possible explanation is that the dividend behavior of U.S. corporations may have changed over time, as suggested by Bagwell and Shoven (1989) and Fama and French (2001). During more recent years, companies may have been more likely to institute a share repurchase program rather than increase their dividends. Compensation practices, where company executives are now more likely to be rewarded with stock options rather than cash bonuses, have encouraged such a change in behavior. Buy-backs tend to increase the value of executive stock

options. The option holder does not receive any dividends that are paid. Finally, it is worth noting that this phenomenon does *not* work consistently with individual stocks. Investors who simply purchase a portfolio of individual stocks with the highest dividend yields in the market will *not* earn a particularly high rate of return. [*]

Time series empirical studies have also found that price-earnings multiples for the market as a whole have considerable predictive power. Investors have tended to earn larger long-horizon returns when purchasing the market basket of stocks at relatively low-price earnings multiples. Campbell and Shiller (1998) have shown that initial P/E ratios explain as much as 40 percent of the variance of future returns. They conclude that equity returns have been predictable in the past to a considerable extent.

Consider, however, the recent experience of investors who have attempted to undertake investment strategies based either on the level of the price-earnings multiple or on the size of the dividend yield to predict future long-horizon stock

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[*] See, for example, Fluck, Malkiel and Quandt (1997)

returns. Price-earnings multiples for the Standard & Poor's 500 stock index were unusually high in mid-1987 (suggesting very low long-horizon returns). Dividend yields fell below 3 percent. The average annual total return from the index over the next 10 years was an extraordinarily generous 16.7 percent. Earnings multiples were also extremely high in the early 1990s but returns remained extremely high until the very end of the decade. We need to be very cautious in assessing the extent to which stock market returns are predictable on the basis of valuation metrics. Studies by Goyal and Welch (2003) and Fisher and Statman (2006) found that neither dividend yields nor price-earnings multiples were useful in generating timing strategies to shift between stocks and bonds that would generate returns exceeding a simple buy-and-hold strategy.

Variance Bound Tests

One kind of empirical test whose results have questioned market efficiency is called a variance bound test. In an efficient market all assets should be priced as the discounted present value of all of their cash flows. In one well-known model of stock valuation popularized by Gordon (1959), the price of a share is

taken to be the discounted present value of the future stream of dividends. LeRoy and Porter (1981), as well as Shiller (1981), then compared the realized variance of the dividend stream (the components of the ex post present value) with the variance of stock prices. They found that the variance of stock prices dramatically exceeds the variance of ex post present values. Stock prices are far too volatile to be explained by the variance of future dividends. Of course it is far from clear how much deviation from "true value" is necessary to declare that stock prices are "too volatile". In his influential article entitled "Noise," Fisher Black (1986) argued that a market should still be considered efficient even if prices deviated in a range of plus 200 percent and minus 50 percent of fundamental value. Nevertheless, Shiller concluded that the excess volatility of stock prices implies that EMH must be false.

Shiller's conclusion has been extremely controversial. Kleidon (1986) and Marsh and Merton (1986) showed that with the kinds of sample sizes used in the tests, sampling variation alone could have generated the Shiller results. But even if the LeRoy-Porter and Shiller findings survive the statistical critiques, there are several reasons to be cautious about interpreting the results as inconsistent with

EMH. For one thing, it is well established that managers tend to smooth dividends; therefore, the ex post variance of dividends may understate the true variance in the fortunes of individual companies. In addition, it is highly unlikely that either real interest rates or required risk premiums are stable over time. Stock prices should adjust with changes in required rates of return, and such price volatility may be entirely consistent with EMH.

There is no reason to believe that individual preferences and behavior will be stable over time. Required risk premiums are likely to be influenced by environmental conditions and when these conditions change the behavior of investors can be expected to change as well. This perspective suggests a more nuanced view of the world of rational expectations. The approach has been championed by Andrew Lo and is called the "Adaptive Markets Hypothesis." This view suggests a quite complicated process to explain the determination of equilibrium risk premiums.*

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*See Farmer and Lo (1999), Lo (2004, 2005), and Brennan and Lo (2009).

Bubbles in Asset Prices

Perhaps the most persuasive argument against market efficiency is that securities markets have often experienced spectacular bubbles. During the so-called "Internet Bubble" that inflated in the late 1990s, any security associated with the "New Economy" soared in price. Companies that changed their names to include dot.net or a similar suffix would often double in price. When the bubble popped, Internet-related stocks lost 90 percent or more of their value. During the housing bubble in the first decade of the 2000s, the inflation-adjusted price of the median single family house doubled after being flat for the entire past century. The associated mispricing of mortgage-backed securities had far-reaching consequences for world financial institutions and for the entire world economy. Critics have considered these episodes to be obvious cases of market inefficiency.

Bubbles often start with some exogenous factor that can be interpreted rationally as presenting large future prospects for profit. In England in the early 1700s, it was the formation of the promising new corporation, the South Sea Company, and the rise of its stock price. The wave of new companies that

followed was expected to provide profitable investment outlets for the savings of individuals. In the United States during the late 1990s, it was the promise of the Internet, which was expected to revolutionize the way consumers obtained information and purchased goods and services. The generation of sharply rising asset prices that followed, however, seemed to have more to do with the behavioral biases emphasized by scholars such as Kahneman and Shiller.*

Tversky and Kahneman (1979, 1984) argued that people forming subjective judgments have a tendency to disregard base probabilities and make judgments solely in terms of observed similarities to familiar patterns. Thus, investors may expect past price increases to continue even if they know from past experience that all skyrocketing stock markets eventually succumb to the laws of gravity. This phenomenon was certainly present during the great housing bubble of 2007-2008. Investors also tend to enjoy the self-esteem that comes from having invested early in some "new era" phenomenon, and they are overconfident of their ability to predict the future.

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* See also Shefrin (2010) for excellent surveys of the behavioral finance literature.

Shiller (2000) emphasized the role of "feedback loops" in the propagation of bubbles. Price increases for an asset lead to greater investor enthusiasm, which then leads to increased demand for the asset and therefore to further price increases. The very observation that prices have been rising alters the subjective judgment of investors and reinforces their belief that the price increases will continue. The news media play a prominent role in increasing the optimism of investors. The media are, in Shiller's view, "generators of attention cascades." One news story begets another, and the price increases themselves (whether of common stocks or single-family houses) appear to justify the superficially-plausible story that started the rise in the price of the asset(s). According to Shiller, bubbles are inherently a social phenomenon. A feedback mechanism generates continuing rises in prices and an interaction back to the conventional wisdom that started the process. The bubble itself becomes the main topic of social conversation, and stories abound about certain individuals who have become wealthy from the price increases. As the economic historian Charles

Kindleberger has stated, "There is nothing so disturbing to one's well-being and judgment as to see a friend get rich."*

The question naturally arises why the arbitrage mechanism of EMH doesn't prick the bubble as it continues to inflate. Enormous profit opportunities were certainly achievable during the Internet bubble for speculators who correctly judged that the prices of many technology stocks were "too high." But the kind of arbitrage that would have been necessary was sometimes difficult to effect and, in any event, was very risky. There appear to be considerable "limits to arbitrage."** For example, in one celebrated case during the Internet bubble, the market price of Palm Pilot stock (which was 95 percent owned by the company 3Com) implied a total capitalization considerably greater than that of its parent, suggesting that the rest of 3Com's business had a negative value. But the arbitrage (sell Palm stock short and buy 3Com stock) could not be achieved because it was impossible to borrow Palm Pilot stock to accomplish the short sale.

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* See Kindleberger (1978).

**See, for example, Shleifer and Vishny (1992) and DeLong, Shleifer, Summers and Waldmann (1990)

Arbitrage is also risky; one never can be sure when the bubble will burst. The mantra of hedge fund managers (the natural arbitragers) in the United States was "markets can remain irrational much longer than we can remain solvent." Moreover, some arbitragers may recognize that a bubble exists but are unable to synchronize their strategies to take advantage of it.* They might prefer to ride the bubble for as long as possible. Indeed, one empirical study by Brunnermeier and Nagel (2004) found that rather than shorting Internet stocks, hedge funds were actually buying them during the late 1990s. Hedge funds were embarking on a strategy of anticipating that the momentum of the price increases would continue and thus were contributing to the mispricing rather than trading against it.

The existence of spectacular bubbles in asset prices is considered by critics as "damning" evidence against the EMH. But even when we know ex post that major errors were made, there were certainly no clear ex ante arbitrage opportunities available to rational investors.

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* See Abreu and Brunnermeier (2003).

Equity valuations rest on uncertain future forecasts. Even if all market participants rationally price common stocks as the present value of all expected future cash flows, it is still possible for excesses to develop. We know, with the benefit of hindsight, that the outlandish claims regarding the growth of the Internet (and the related telecommunications structure needed to support it) were unsupportable. We know now that projections for the rates of growth and the stability and duration of those growth rates for "New Economy" companies were unsustainable. But neither sharp-penciled professional investors nor quantitative academics were able to accurately measure the dimensions of the bubble or the timing of its eventual collapse.

As indicated above, there is evidence that initial dividend yields for the market as a whole have considerable predictive power to explain future long-horizon rates of return. But during the early 1990s, dividend yields in the United States fell well below three percent, implying very low rates of return for the next five to ten years. In fact, the U.S. stock market generated unusually large double digit rates of return during the entire decade of the 1990s. In 1996, Campbell and Shiller presented a paper to the board of governors of the U.S. Federal Reserve

System showing that price-earnings multiples for the overall market possessed substantial ability to predict future rates of return.* Since P/E multiples were extraordinarily high at that time, the work implied a likelihood of very low or even negative rates of return. This work influenced Alan Greenspan (1996), then Chairman of the Board of Governors, to question whether the stock market was at bubble levels and to suggest that investors were exhibiting "irrational exuberance." The stock market rallied strongly for more than four years thereafter. We know now (ex post) that market prices were at bubble levels in late 1999 and early 2000. No one was able accurately to identify the timing of the bubble in advance. And certainly no riskless arbitrage opportunities existed, even at the height of the bubble.

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* The paper was published in 1998

Hyman Minsky and the 2007-2008 Financial Crisis

The financial crisis of 2007-2008 reinforces two important lessons that may sometimes be overlooked by policy makers. First, it is critical to distinguish between asset-price bubbles that are financed by debt and those that inflate without a major increase in indebtedness. The former are far more dangerous than the latter. The bursting of Internet bubbles in early 2000 did usher in a period of poor macroeconomic performance in the United States and in other world economies. But the recession that followed was moderate and relatively short lived. The bursting of the real estate bubble in 2007 had far more serious consequences. Because individual balance sheets as well as those of financial institutions had become overextended in debt, there were serious adverse effects on consumer spending and on the ability and willingness of financial institutions to lend.

Debt to income ratios of individuals, which have historically measured about one third, rose to a level well above 100 percent during the boom as people bought houses with lower and lower down payments and tapped the equity in their houses by assuming second mortgages. Leverage ratios of financial

institutions also increased dramatically. Debt to equity ratios of investment banks such as Bear Stearns and Lehman Brothers reportedly exceeded 30 to 1. Moreover, the debt was short term rather than long term. As investors in the short-term paper of those institutions began to worry about the quality of the mortgage-backed securities on the asset side of the investment banks' balance sheets, they refused to roll over their loans and we experienced a classic run on the banks. Commercial banks also became dangerously overleveraged and a collapse of the financial system was avoided only by extraordinary measures undertaken by government authorities.

These events give us a renewed appreciation of the work of Hyman Minsky (1982, 2008), who stressed that stability itself breeds the seeds of instability in a capitalist system. Periods of economic expansion and relative stability lead individuals and institutions to reduce the premiums they demand to hold risky assets and to tolerate greater amounts of debt than they had previously accepted. The increased willingness of borrowers to borrow and lenders to lend leads to a growth in the availability and flow of credit, which in turn drives up asset prices to levels that may be inconsistent with their "fundamental

valuations." Precautionary lending practices are replaced with what Minsky has called "Ponzi Finance." Ponzi loans are characterized as loans to borrowers whose operating cash flow is insufficient to pay down principal so that the loans must continually be refinanced. The process ends with what has been called a "Minsky Moment."

Market participants begin to believe that asset prices are "unsustainably high" and they attempt to cash in their profits before prices collapse. Lenders are reluctant to make new loans and refuse to renew the loans already outstanding. Investors demand higher risk premiums and attempt to alter the composition of their portfolios to increase the liquidity of the instruments they hold. As a result of a rush to exit risky holdings, there are "fire sales" of all risk assets. Prices decline dramatically and markets become less liquid. In the extreme case, a full fledged financial crisis ensues.

There is little doubt that the Minsky model seems an especially good description of the recent financial crisis. Minsky's financial instability hypothesis is also consistent with the insights of behavioral finance and with the tendency of market systems to experience periodic bubbles. But even when we know ex post

that asset prices were "wrong," the fundamental characteristic of efficient markets remains valid. Markets can make "mistakes," sometimes egregious ones, and those mistakes can have extremely unfortunate macroeconomic consequences. But there were no obvious ex ante arbitrage opportunities. While some hedge funds did profit from selling short mortgage-backed securities, other investment funds and financial institutions went bankrupt because they held long positions in these same instruments and financed those positions exclusively with short-term debt. * What Minsky's work does make clear, however, is that policy makers need to be very alert to increases in asset prices that are financed with debt. Both the amount and the maturity of the debt on individual and institutional balance sheets are crucial variables. It is debt-financed asset price bubbles that have the most serious macroeconomic effects.

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* Highly complex derivatives invite asymmetries of information and therefore opportunities for large profits. Such opportunities are inconsistent with the strong form of EMH, which I have suggested is unlikely to hold in practice. Moreover, in a paper in this volume Robert Jarrow has suggested that some arbitrage opportunities arose from improper ratings published by the rating agencies

The “mistakes” that markets sometimes make can also have undesirable microeconomic effects. We count on financial markets to allocate the economy’s scarce capital resources to the most productive uses. We know that the overpricing of internet stocks in 1999 and early 20000 led to the financing of many fanciful business ventures and to an overinvestment in long-distance fiber optic cable that was sufficient to span the globe multiple times. We know that during the housing bubble of the first decade of the 2000s that far too many houses were built and again that investment capital was badly allocated. The more difficult question is evaluating the costs and benefits of a market based allocation system is what it should be compared with. Certainly few would agree that a Soviet-type central planning system is likely to make better allocation decisions.

The Performance of Professional Investors

Perhaps the most convincing tests of market efficiency are direct tests of the ability of professional investment managers to outperform the market as a

whole. If market prices were generally determined by irrational investors and if it were easy to identify predictable patterns in security returns or exploitable anomalies in security prices, then professional investment managers should be able to beat the market. Direct tests of the actual returns earned by professionals, who are often compensated with strong incentives to outperform the market, should represent the most compelling evidence of market efficiency.

A large body of evidence suggests that professional investment managers are not able to outperform index funds that buy and hold the broad stock market portfolio. One of the earliest studies of mutual fund performance was undertaken by Jensen (1968). He found that active fund managers were unable to add value. Using a risk-adjustment model motivated by the capital-asset pricing model, he found that actively-managed mutual funds tended to underperform the market by approximately the amount of their added expenses. I repeated Jensen's study with data from a subsequent period and confirmed the earlier results (Malkiel, 1995).

Carhart (1997) used a different method of risk adjustment in appraising the performance of actively-managed mutual funds. Risk was measured in terms of a

four-factor model. In addition to the CAPM, beta, the two Fama-French risk factors of "value" (low price to book value) and "size" were used, as well as a "momentum" factor. Carhart found that most mutual funds underperformed the market on a risk-adjusted basis. While the best funds were able to earn back their expenses with higher gross returns, net returns were no better than could be earned by a low-cost broad-based index fund. Carhart's study is consistent with previous work suggesting that professional investors are unable to beat the market.

Studies of mutual fund returns must take account of certain biases in many data sets. The degree of "survivorship bias" in the data is often substantial. Poorly performing funds tend to be merged into other funds in the mutual fund's family complex, thus burying the records of many of the underperformers. Exhibit 1 updates the study I performed during the mid-1990s through the first decade of the 2000s. The analysis shows that the returns for surviving funds are considerably better than the actual return for all funds, including funds liquidated or merged out of existence. Data available for mutual fund returns generally show only the returns for currently available funds, i.e., for those funds that

survived. Survivorship bias makes the interpretation of long-run mutual fund data sets very difficult. But even using data sets with some degree of survivorship bias, one cannot sustain the argument that professional investors can beat the market.

Exhibit 1
The Records of Surviving Funds Overstates the Success of Active Management

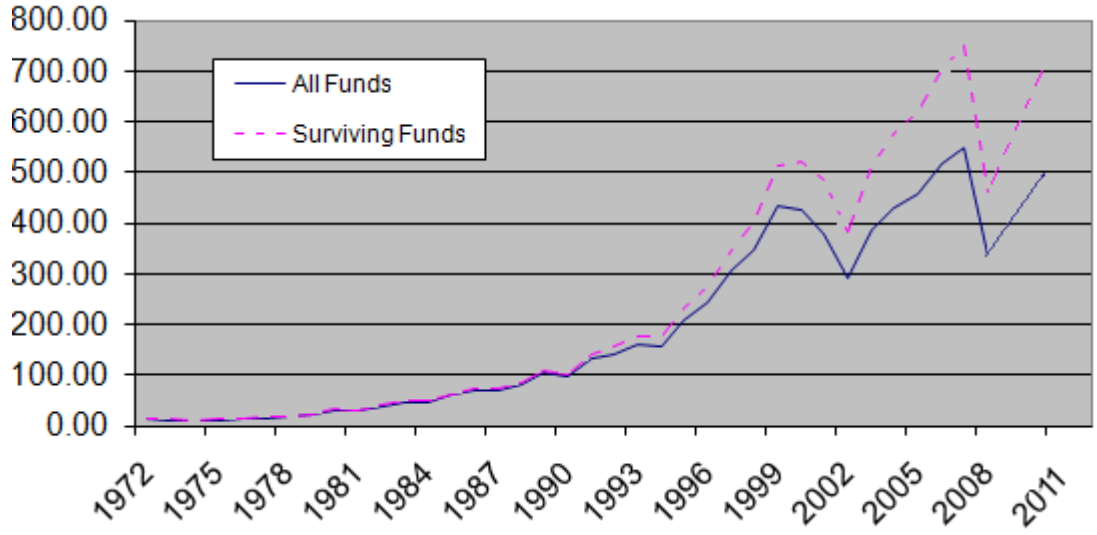


Exhibit 2 shows the percentage of actively-managed mutual funds that have been outperformed by their relevant passive benchmarks. In general, two thirds of actively-managed funds are outperformed by their benchmark indexes. Similar results can be shown for earlier five-year periods as well as for 10 and 20-year periods. Moreover, the funds that do have superior records in one base period are not the same in the next. There is little persistence in mutual fund returns

with the possible exception that very high-expense, poorly-performing funds in one period tend to do poorly in the next. Managed funds are regularly outperformed by broad index funds with equivalent risk. The median actively managed mutual fund underperforms its benchmark by about 80 to 90 basis points (eight to nine tenths of one percent), which is approximately the additional expenses charged by the fund's management.

Exhibit 2
Percentage of U.S. Equity Funds Outperformed by Benchmarks

Five Year through 2010

Fund Category	Benchmark Index	Percent Outperformed
All Domestic Equity	S&P 1500	57%
All Large Cap Funds	S&P 500	62
All Mid-Cap Funds	S&P Mid-Cap 400	78
All Small-Cap Funds	S&P Small-Cap 600	63
All Multi-Cap Funds	S&P Small-Cap 1500	66
Global Funds	S&P Global 1200	59
International Funds	S&P 700	85
Emerging Market Funds	S&P/IFCI Composite	86

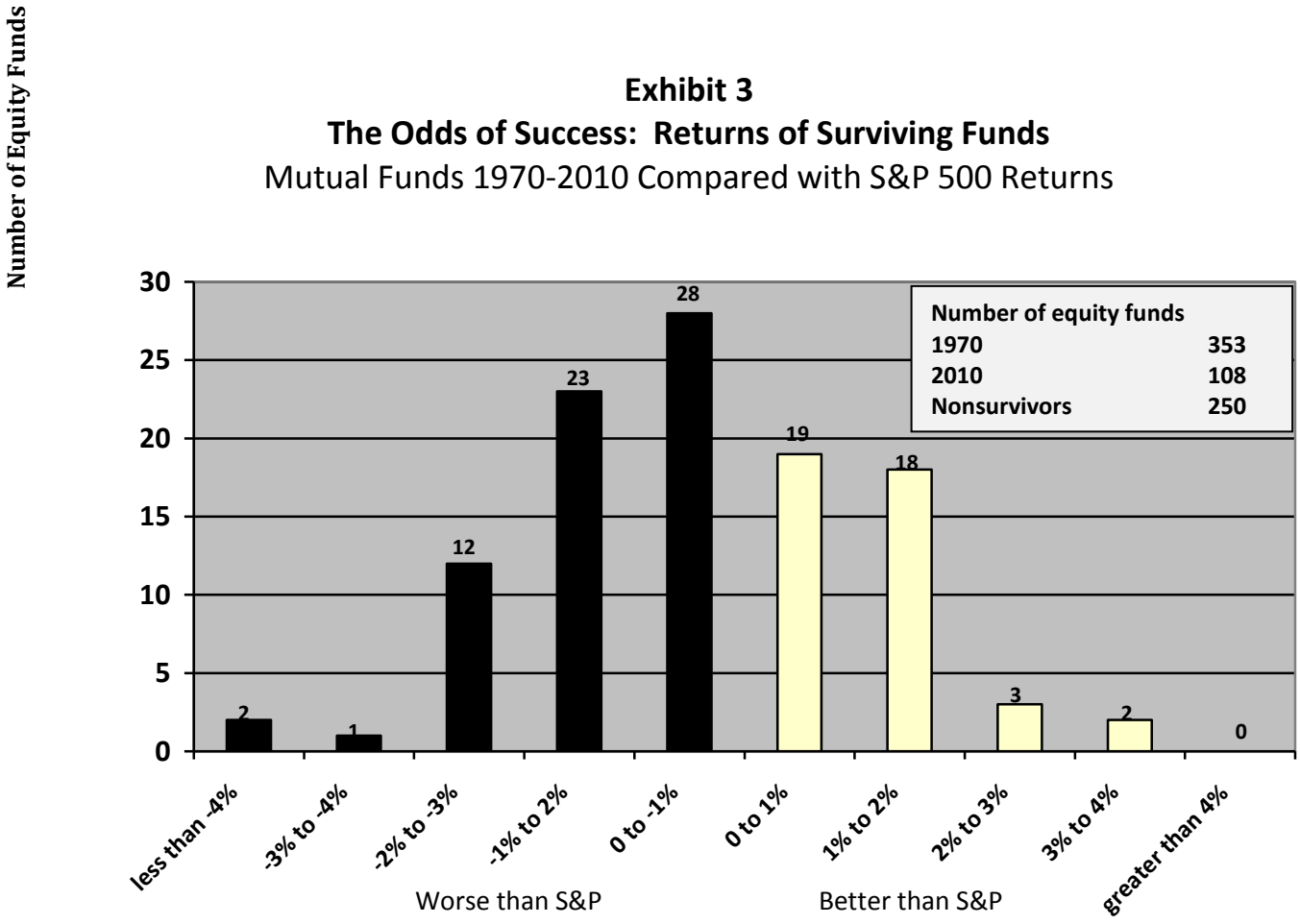
Of course, for any period one can find a number of fund managers who have produced well-above average returns. But there is no dependable

persistence in performance. During the 1970s, the top 20 mutual funds enjoyed almost double the performance of the index. During the 1980s, those same funds underperformed the index. The best performing funds of the 1980s failed to outperform in the 1990s. And the funds with the best records during the 1990s, which tended to be those with concentrations of "New Economy" stocks, had disastrous returns during the first decade of the 2000s.

Exhibit 3 presents a forty-year record of actively-managed mutual funds and the Standard and Poor's 500 stock index, a benchmark frequently used to measure overall market returns. It plots the performance of all mutual funds that have been available over the entire period. In 1970, there were 358 equity mutual funds in the United States. (Today there are thousands of funds.) Only 108 of those original funds survived through the end of 2010. All we can do is measure the relative performance versus the market for these surviving funds. We can be sure, however, that the 250 funds that did not survive had even worse records. Yet even though these data are tainted by survivorship bias, we find that the vast majority of the mutual funds that have been in existence for 40 years have underperformed an index that has served as the basis for the most popular

indexed mutual funds and exchange-traded funds (ETFs). And one can count on the fingers of one hand the number of professionally-managed mutual funds that have outperformed the S&P 500 index by two percentage points or more per year.

Exhibit 3
The Odds of Success: Returns of Surviving Funds
Mutual Funds 1970-2010 Compared with S&P 500 Returns



Similar kinds of results have been observed for other professional investors such as pension funds and insurance-company portfolios.* A variety of biases—such as inclusion bias, backfill bias, and survivorship bias—make the interpretation of hedge-fund returns problematic.** But it does not appear that hedge funds, as a group, are able to produce abnormal returns for their clients.*** If markets were dominated by irrational investors who make systematic errors in valuing equities, we should expect that professional investors, who are well incentivized to beat the market, would realize relatively generous returns. If persistent anomalies were obvious to uncover, and if bubbles were easy to spot, a simple passively-managed equity fund that buys and holds all the stocks in the market would not display the degree of superiority that it does.

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* See, for example, Swensen (2005, 2009).

** See, for example, Malkiel and Saha (2005).

*** Not even the upwardly biased HFRI hedge fund index has outperformed the S&P 500 stock index as shown by Jurek and Stafford (2011).

Large arbitrage opportunities do not persist. And while markets can and do make mistakes – some of them horrendous – it is extraordinarily difficult to recognize such situations ex ante. Certainly such examples of mispricing that are recognized ex post do not provide opportunities for risk-adjusted extraordinary returns.

The wisdom of the market appears to produce a tableau of prices which, while certainly not always correct, is hard to second guess. It is therefore difficult for me to resist the conclusion that our financial markets are remarkably efficient, and that EMH remains a most useful hypothesis approximating how our financial markets actually work.

Concluding Comments

In the final analysis, it is probably useful to think of the stock market in terms of "reasonable market efficiency" or "relative market efficiency" rather than absolute efficiency. Andrew Lo (2007) has suggested that few engineers would even contemplate performing a statistical test to determine if a given

engine was perfectly efficient. But they would attempt to measure the relative efficiency of that engine relative to a frictionless ideal. Similarly, it is unrealistic to require our financial markets to be perfectly efficient in order to accept the basic tenets of EMH. Indeed, as Grossman and Stiglitz (1980) have argued, the perfect efficiency of our financial markets is an unrealizable ideal. Those traders who ensure that information is quickly reflected in market prices must be able at least to cover their costs. But it is reasonable to ask if our financial markets are relatively efficient, and I believe that the evidence is very powerful that our markets come very close to the EMH ideal.

Information does get reflected rapidly into security prices. Thus, to return to our analogy of the $100 bill lying on the ground, it is highly unlikely that we should find them persisting for any length of time. There may well be some loose pennies around. They will be picked up only if justified by the cost involved in exploiting the opportunities available. Thus, professional managers may well earn the fees they charge. Their profits, in effect, reflect economic rents. But what seems abundantly clear is that investors in actively-managed funds do not reap

any benefits over and above those they would earn from a low-cost, broad-based, positively-managed index fund.

I would draw one more conclusion from this discussion of the efficient market hypotheses. EMH and Behavioral Finance (BF) should not be considered as competitive models. BF provides important insights into the formation of expectations and the process by which valuations are determined. And as the pages in this volume by Shefrin and Statman (2011) makes clear, BF does not argue that the behavioral biases of investors make the market "beatable." Moreover, the insights of Minsky help explain that required risk premiums are influenced by environmental conditions. Policy makers will be well served by internalizing Minsky's central theses that financial markets – even if efficient in the sense I have used the term – are able to inflict substantial damage on the real economy.

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