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The Global Financial Crisis and the Efficient Market Hypothesis: What Have We Learned?

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The sharp economic downturn and turmoil in the financial markets, commonly referred to as the "global financial crisis," has spawned an impressive outpouring of blame. Free market economics—the idea that coordinated political forces do not improve on the "atomistic" actions of individuals—has come under concerted attack. The Efficient Market Hypothesis (EMH)—the idea that competitive financial markets ruthlessly exploit all available information when setting security prices—has been singled out for particular attention.

As one prominent example, market strategist Jeremy Grantham has called the EMH "responsible for the current financial crisis" because of its role in the "chronic underestimation of the dangers of asset bubbles" by financial executives and regulators.[1] And in the prologue and epilogue to his meticulously researched, well-written, and best-selling history of modern financial economics, *The Myth of the Rational Market*, Justin Fox appears to say much the same thing.[2] The reasoning boils down to this: swayed by the notion that market prices reflect all available information, investors and regulators felt too little need to look into and verify the true values of publicly traded securities, and so failed to detect an asset price "bubble." The Turner Report by the UK's market regulator (discussed more fully below) reaches a similar conclusion. And in a fit of soul-searching, the *University of Chicago Magazine* asks: "Is Chicago School Thinking to Blame?"[3] These are but a handful of the many accusations that have been heaped on the EMH.

I have argued in the past and will argue below that the EMH—like all good theories—has major limitations, even though it continues to be the source of important and enduring insights.[4] Despite the theory's undoubted limitations, the claim that it is responsible for the current worldwide crisis seems wildly exaggerated.

If the EMH is responsible for asset bubbles, one wonders how bubbles could have happened before the words "efficient market" were first set in print—and that was not until 1965, in an article by Eugene Fama.[5] Economic historians typically point to the 1637 Dutch tulip "mania" as the first such event on record, followed by episodes like the 1720 South Sea Company Bubble, the Railway Mania of the 1840s, the 1926 Florida Land Bubble, and the events surrounding the market collapse of 1929. But all of these episodes occurred well before the advent of the EMH and modern financial economic theory. As the above list suggests, unusually large price run-ups followed by unusually large drops have occurred throughout the recorded history of organized markets. It's only the idea of market efficiency that is relatively new to the scene.

Further, the argument that a bubble occurred because the financial industry was dominated by EMH-besotted "price-takers"—that is, by people who viewed current prices as correct and so failed to verify true asset values—seems wildly at odds with what we see in practice. Almost all investment money is actively managed, despite all the evidence of academic and industry studies showing that active managers fail to beat the market in an average year.[6] Money flows into mutual funds strongly follow past performance, as if individual managers consistently beat the market over time, and despite the evidence that the past performance of most

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1. Cited (with apparent approval) in a widely read *New York Times* business column, Joe Nocera, "Poking Holes in a Theory on Markets," *New York Times,* June 5, 2009. www.nytimes.com/2009/06/06/business/06nocera.html?scp=1&sq=efficient%20market&st=cse. See also Grantham's foreword in Andrew Smithers, *Wall Street Revalued: Imperfect Markets and Inept Central Bankers* (Chichester, UK: Wiley, 2009).

2. Justin Fox, *The Myth of the Rational Market: A History of Risk, Reward, and Delusion on Wall Street* (New York: HarperCollins, 2009), page 320. See also: George Cooper, *The Origin of Financial Crises: Central Banks, Credit Bubbles, and the Efficient Market Fallacy* (New York: Vintage Books, 2008); Richard A. Posner, *A Failure of Capitalism: The Crisis of '08 and the Descent into Depression* (Boston: Harvard University Press, 2009); George Soros, *The Crash of 2008 and What it Means: The New Paradigm for Financial Markets* (New York: Perseus, 2009); and Andrew Smithers, *op. cit*.

3. Cover story, *University of Chicago Magazine*, Vol. 102 No. 1, September-October 2009.

4. Ray Ball, "The Theory of Stock Market Efficiency: Accomplishments and Limitations," *Journal of Applied Corporate Finance* 8, Spring 1995, pp. 4-17, and "On the Development, Accomplishments and Limitations of the Theory of Stock Market Efficiency," *Managerial Finance* 20 (issue no.2/3), 1994, pp. 3-48.

5. Fama referred to "an 'efficient' market for securities, that is, a market where, given the available information, actual prices at every point in time represent very good estimates of intrinsic values." Eugene F. Fama, "The Behavior of Stock-Market Prices" *The Journal of Business*, Vol. 38, No. 1 (January 1965), p. 90. The idea did not become known outside of narrow academic circles until the 1970s. It was not an easy sell to practitioners at the time.

6. The first of the many studies reaching this finding is Michael C. Jensen, "The Performance of Mutual Funds in the Period 1945–1964," *Journal of Finance* 23 (May 1968), pp. 389–416. A recent Morningstar report concludes that only 37% of managed funds outperformed their respective Morningstar style indexes over the past three years, adjusting for risk, size and style. Similar numbers were observed for five and 10-year returns.

See: http://news.morningstar.com/newsnet/viewnews.aspx?article=/dj/20091007131 4dowjonesdjonline000480_univ.xml.

money managers is a poor predictor of future performance.[7] Much of the enormous losses by banks and investment banks in 2007-2008 originated in their trading desks and proprietary portfolios, whose strategies and very existence were premised on making money from market mispricing. Investors who poured money into the property market, stock market, and other asset markets in the years while the "bubbles" were forming seemed to do so in the belief that prices would continue to rise, with the implication that they believed current prices were incorrect. It seems inconsistent to argue simultaneously that asset price "bubbles" occur and that investors passively believe current asset prices are correct. Yet this is precisely what many EMH critics have claimed. But if more homeowners, speculators, investors, and banks had indeed viewed current asset prices as correct, they might not have bid them up to the same extent they did, and the current crisis might have been averted.

The related argument that when asset prices are rising rapidly their level is not subject to scrutiny by investors also seems wildly at variance with the facts. Take the case of then Fed Chairman Alan Greenspan's 1996 use of the words "irrational exuberance." Despite its seemingly innocuous nature and positioning in a long and otherwise unheralded speech, the reference received widespread media coverage both at the time, and more or less continuously during the decade before the financial crisis.[8] When my recent Google search of "Alan Greenspan irrational exuberance speech" yielded over six million hits,[9] I had to ask myself: Can we really believe that investors were not aware of the possibility of a stock market bubble?

Perhaps it is not surprising that blame for the crisis has been leveled at the EMH. Many investors and employees have incurred considerable losses, regulators have lost face, and scapegoats are needed. The EMH is a natural candidate. It sounds academic. It is not welcomed by most money managers because it states what they are not honest enough to admit to their clients: that they operate in a fiercely competitive world, populated by a large number of capable and ambitious people just like themselves, and thus superior investment returns are generally (though not exclusively) attributable more to luck than insight. To justify their fees, active money managers have to argue they are "above average" and consistently beat the market, but the EMH—and the body of empirical studies supporting it—suggests otherwise. The theory is also viewed with skepticism by many (if not most) of the large number of MBA students who launch forth into the world every year, each believing—as the behavioral studies tell us—that he or she is substantially above average, even though they are their own future competition. The idea that it is hard to earn excess returns in a competitive market also threatens the lucrative market for an astonishing range of "get-rich-quick" consultancies and treatises. In my experience, people whose living derives from commenting authoritatively on the actions of others—notably, academics, financial advisers, consultants, journalists, and book authors—are more inclined than most to view others as less rational than themselves.[10] So the notion of market efficiency is a natural target for blame.

Asset bubbles are not a well-understood phenomenon in general. Many serious economists have challenged the use of the term, other than in the *ex post* sense of denoting episodes in which prices rose and then fell by substantial amounts. Trying to pin such episodes on the EMH therefore does not strike me as a very constructive exercise. To my mind there is less drama, but more insight, to be gained by examining what the crisis tells us about the efficient markets theory. Does the rapid and substantial fall in prices that occurred across countries and asset classes invalidate the notion of market "efficiency"? Or does it merely serve to remind us of its considerable limitations as a theory to help us understand the behavior of asset prices? If so, then what are those limitations?

What Does the EMH Say?

The basic idea behind the EMH is deceptively simple. It merges two insights. The first is one of the simplest and most powerful insights of economics, the notion that competition enforces a correspondence between revenues and costs. If profits are excessive, new entry reduces or eliminates them. The second insight, which is Gene Fama's, is to view changes in asset prices as a function of the flow of information to the marketplace. Putting these two insights together leads to the EMH, which I interpret as saying just this: competition among market participants causes the return from using information to be commensurate with its cost.

This fundamental idea leads directly to a startling—and testable—prediction about financial markets' reactions to publicly released and widely-disseminated information, such as corporate quarterly earnings reports. In competitive equilibrium, the gains from exploiting public information should correspond to the cost of exploiting it. But to a first approximation, public information is costless to obtain, and

7. E. Sirri and P. Tufano, "Costly Search and Mutual Fund Flows," *Journal of Finance*, 53 (1998), pp. 1589-1622.

8. The complete reference is: "But how do we know when irrational exuberance has unduly escalated asset values, which then become subject to unexpected and prolonged contractions as they have in Japan over the past decade? And how do we factor that assessment into monetary policy?" *The Challenge of Central Banking in a Democratic Society*: Remarks by Chairman Alan Greenspan at the Annual Dinner and Francis Boyer Lecture of The American Enterprise Institute for Public Policy Research, Washington, D.C., December 5, 1996 (Washington, DC: The Federal Reserve Board).

9. Visited October 18, 2009.

10. It also seems worth pointing out that such people, having chosen these occupations and careers, have *incentives*, monetary and otherwise, to view themselves as more rational than their audiences.

11. Eugene F. Fama, "Mandelbrot and the Stable Paretian Hypothesis," *Journal of Business*, Volume 36, Issue 4 (October 1963), pp. 420-429.

hence the gains from its use should be competed away to zero. From this comes the prediction that one cannot expect to earn above-normal returns from using publicly available information because it already is reflected in prices.

Simple as it might seem in hindsight, this reasoning was revolutionary at the time. While it was not by any means a complete description of how security prices behave, and its deficiencies became more apparent over time, the EMH irreversibly changed the thinking of not only economists—but of a great many practitioners—about how securities markets behave.

What Doesn't the EMH Say?

The EMH has been the subject of so much misunderstanding that outlining some of the things the hypothesis does *not* say occupies considerably more space than what it *does* say.

1. No one should act on information.

What would happen if all investors passively indexed their portfolios? Obviously, the market would cease to be efficient, because no investors would be acting to incorporate information into prices. This has been a source of misunderstanding from the outset. The misunderstanding arises from confusing efficiency as a statement about the equilibrium resulting from investors' actions with the actions themselves. Hair salons operate in a fiercely competitive market, and the average salon is not expected to make abnormal returns. That does not say all salons should stop cutting hair. Investors act on information in a fiercely competitive market, and the average investor is not expected to make abnormal returns. That does not say all investors should stop acting on information.

Yet this is the essence of the claim that market participants were seduced into believing that since market prices already reflected all available information, there was nothing to gain from producing information and, as a consequence, security prices were allowed to deviate substantially from their true values. The critique confuses a statement about an equilibrium "after the dust settles" and the actions required to obtain that equilibrium.

2. The market should have predicted the crisis.

The EMH does not imply that one can—or should be able to—predict the future course of stock prices generally, and crises in particular. Exactly the opposite: if anything, the hypothesis predicts we should *not* be able to predict crises. If we could predict a market crash, current market prices would be inefficient because they would not reflect the information embodied in the prediction.

Furthermore, the existence but unpredictability of *large* market events is consistent with the work of Fama himself and Benoît Mandelbrot on so-called "Paretian return" distributions—that is, distributions of possible outcomes that have "fat tails," or more frequent extreme observations than expected from the more-familiar bell-shaped "normal curve."[11] Under the EMH, then, one can predict that large market changes will occur, but one can't predict when.

3. The stock market should have known we were in an asset "bubble."

It is easy to identify bubbles after the fact, but notoriously difficult to profit from them. For example, let's go back to Alan Greenspan's famous reference to "irrational exuberance." The speech was given on December 5, 1996, a day on which the Dow Jones closed at 6437. If that statement is taken to mean that prices were too high at the time, the clear implication is that by today—when we all know how inefficient the market is and how irrationally exuberant we were 13 years ago, and after we have had ample opportunity to change our behavior in response to that knowledge—there should have been a substantial price correction. But at the time of this writing, the Dow is near 10,000, a full 50% higher than when Greenspan spoke.[12] In other words, after 13 years to reflect on Greenspan's warning, investors are not acting as if there was a bubble when he sounded the warning.

Asset price bubbles, or episodes in which prices rise and then fall by substantial amounts, are much easier to spot using hindsight than they are to predict. I like to ask a simple question of people who believe that most stock market investors ignored a pre-crisis bubble that burst in 2007-08. My question is whether, prior to the crisis, they personally had withdrawn from the stock and real estate markets and put their wealth into cash instead. To my mind, this is the only reliable test of whether they believed there was a bubble and distrusted market prices *at the time*. In my limited experience few withdrew much. By this test, I—a financial economist skeptical about the possibility of identifying asset bubbles except in hindsight—seem to have been more wary of a bubble than the people who blame "the market" (but not themselves) for creating it.

4. The collapse of large financial institutions indicates the market is inefficient.

George Soros, in his most recent book, has opined: "On a deeper level, the demise of Lehman Brothers conclusively falsifies the efficient market hypothesis."[13] I would have thought the opposite. To me, Lehman's demise conclusively demonstrates that, in a competitive capital market, if you take massive risky positions financed with extraordinary leverage, you are bound to lose big one day—no matter how large and venerable you are. Market efficiency does not predict there will be no spectacular failures of large banks or investment banks.

12. The increase exceeds the 35% consumer price inflation over the period.

13. George Soros, *op. cit*, p. 165.

If anything, it predicts the opposite—that size and venerability alone will not guarantee you positive abnormal returns, and will not protect you from the forces of competition.

5. The EMH assumes that return distributions do not change over time.

The EMH is completely silent about the shapes of the distributions of securities' returns. Indeed, I will argue below that this is one of the principal limitations of the theory. This has been a glaring hole in "modern" financial economic theory in general, going all the way back to Irving Fisher's work on the discounted present value model a century ago. The EMH does not imply that past return distributions—including statistics such as means, variances, skewness, and correlation matrices—will mechanically repeat themselves in the future. What the EMH does say about return distributions is that, *given* a certain amount and kind of publicly available information, security prices are "efficient" in the statistical sense that they are "minimum-variance" forecasts of future prices. In other words, to the extent that a price has already adjusted to the available information, no future price reaction to that information is necessary, and the investor is not exposed to future price variability arising from that source. By contrast, a market that adjusts only partially to information when it arrives leaves the investor exposed to further reaction at a later date, thereby resulting in excessive variability, and hence "inefficient" prices.

In sum, the EMH says nothing about the stationarity over time of return distributions. There is no *deus ex machina* in securities markets that ensures the stability of such variables, no economic forces that mechanically draw security returns like lottery numbers every day from the same barrel. Quite the contrary: there is considerable evidence that risk in particular is "non-stationary" to an important degree. So if financial economists—or math and physics majors with little appreciation of long-term economic history posing as financial economists—calculate future risks entirely from recent historical data, they do so as an act of belief rather than theory, and they ignore evidence contrary to that belief. One cannot blame the EMH for such practices.

Yet the EMH is cited as playing a major role in the crisis in the Turner Review, a post mortem report issued by the U.K.'s market regulator at the request of the Chancellor of the Exchequer. Consider this summary of the report's conclusions on market efficiency:[14]

> *At the core of these assumptions has been the theory of efficient and rational markets. Five propositions with implications for regulatory approach have followed:*
>
> *(i) Market prices are good indicators of rationally evaluated economic value.*
> *(ii) The development of securitised credit, since based on the creation of new and more liquid markets, has improved both allocative efficiency and financial stability.*
> *(iii) The risk characteristics of financial markets can be inferred from mathematical analysis, delivering robust quantitative measures of trading risk.*
> *(iv) Market discipline can be used as an effective tool in constraining harmful risk taking.*
> *(v) Financial innovation can be assumed to be beneficial since market competition would winnow out any innovations which did not deliver value-added.*
>
> *Each of these assumptions is now subject to extensive challenge on both theoretical and empirical grounds, with potential implications for the appropriate design of regulation and for the role of regulatory authorities.*

Only the first of these five propositions bears any resemblance to the simple notion of efficient price responses to information. The third proposition—that market efficiency implies there are "robust quantitative measures of trading risk"—involves a considerable exaggeration of the theory's prescriptive import.

6. Financial regulators mistakenly relied on the EMH.

The crisis has prompted many to conclude that financial regulators were excessively lax in their market supervision, due to a mistaken belief in the EMH. This conclusion is made explicit in the UK's Turner Review. Perhaps not surprisingly, the report advocates more regulation.[15] It reasons as follows:[16]

> *The predominant assumption behind financial market regulation—in the US, the UK and increasingly across the world—has been that financial markets are capable of being both efficient and rational and that a key goal of financial market regulation is to remove the impediments which might produce inefficient and illiquid markets.… In the face of the worst financial crisis for a century, however, the assumptions of efficient market theory have been subject to increasingly effective criticism.*

This characterization of what the EMH implies for regulators makes sense in one respect. If the market does a good job of incorporating public information in prices,

14. *The Turner Review: A Regulatory Response to the Global Banking Crisis* (London, UK: The Financial Services Authority, March 2009, page 39).

15. Consistent with Peltzman's theory that increased regulation generally is a political attempt to escape blame for crises. See Sam Peltzman, "Toward a More General Theory of Regulation," *Journal of Law and Economics* 19 (1976), pp. 211-240.

16. *Ibid,* pages 39-40.

regulators can focus more on ensuring an adequate flow of reliable information to the public, and less on holding investors' hands. Consistent with this view, in recent decades there does appear to have been increased emphasis by regulatory bodies worldwide on ensuring adequate and fair public disclosure.

Otherwise, the characterization of the role of the EMH in the crisis falls short of the mark. If regulators had been true believers in efficiency, they would have been considerably more skeptical about some of the consistently high returns being reported by various financial institutions. If the capital market is fiercely competitive, there is a good chance that high returns are attributable to high leverage, high risk, inside information, or dishonest accounting. True believers in efficiency would have looked more closely at the leverage and risk-taking positions of Lehman Brothers, Bear Sterns, AIG, Freddie Mac and Fannie Mae, and banks and investment banks generally. They might have questioned the source of the trading profits of hedge funds like Galleon, and discovered some using inside information. And they would have been exceptionally skeptical of the surreally high and stable returns reported over an extended period by Bernie Madoff.[17]

Some Lessons from the Financial Crisis

So, what have we learned about market efficiency from the financial crisis? The short answer is: some things we should have known beforehand.

1. A Theory is Just a Theory.

First and foremost, the episode highlights that a theory is just that—a theory. It is not a fact. It is an abstraction from reality. It is an abstraction that we hopefully find useful when organizing our thoughts and actions, but no theory is perfect. As Thomas Kuhn, the well-known historian of science, reminds us, all theories have "anomalies"—facts or findings that the theories cannot explain.[18] No theory can or should totally determine our thoughts or our actions. People who take theories literally are in for a disappointment.

Further, specific models of a theory are even greater abstractions. They are ways of implementing the basic ideas in a theory, using more detailed and more specific assumptions that adapt the theory for particular purposes. They cannot and should not be taken literally. For example, the Capital Asset Pricing Model takes the basic concept of correct pricing and adds a number of assumptions about return distributions to come up with a more specific and implementable pricing model. It therefore is less robust than the basic idea of correct pricing. People who take models literally are in for a very big disappointment.

No theory can explain everything. This is a central point in Kuhn: anomalies abound in all theories, but we are prepared to live with them if we find the theory to be more useful than the best alternative. In other words, it takes a theory to beat a theory—a theme I come back to later when discussing the contributions of "behavioral finance."

An analogy might be helpful here. One can view the proposition "man is moral" as a useful way of thinking about the world, without taking it to mean that no person ever has acted or will act immorally, or without implying any of the following: (1) that one knows exactly what "moral" means; (2) that there are no logical inconsistencies in one's views about what constitutes "moral" behavior under different circumstances; or (3) that one cannot design an experiment in which people act inconsistently with a particular definition of "morality." The same is true of market "efficiency."

2. There are Limitations to the EMH as a Theory of Financial Markets.

At a theoretical level, the EMH has many obvious limitations. The most important of these limitations stems from the fact that EMH is a "pure exchange" model of information in markets. What this means is that the theory makes no statements whatsoever about the "supply side" of the information market: about how much information is available, whether it comes from accounting reports or statements by managers or government statistical releases, what its reliability is, how continuous it is, the frequency of extreme events, and so forth. The theory addresses only the demand side of the market. The EMH says only that, *given* the supply of information, investors will trade on it until in equilibrium there are no further gains from trading. Consequently, the EMH is silent about the shapes of return distributions and how they evolve over time.

An almost exclusive focus on the demand side is perhaps the single biggest weakness of "modern" financial economics generally. The discounted present value, or NPV, model for valuation and capital budgeting states that, *given* an expected stream of future cash flows, those cash flows are priced so as to provide investors a given return. The Miller-Modigliani theorems state that, *given* corporate investment decisions and the earnings from that investment, pure exchange among

17. SEC Inspector General David Kotz concludes his report on the Commission's handling of the case as follows: "Despite numerous credible and detailed complaints, the SEC never properly examined or investigated Madoff's trading and never took the necessary, but basic, steps to determine if Madoff was operating a Ponzi scheme." Three of the six complaints came from Harry Markopolos, who raised 30 "red flags." These included his calculation that there simply were not enough S&P-100 options in existence to generate the dollar returns Madoff was reporting from trading in them, and his analysis that Madoff's claimed return stream was consistent with no known investment strategy. In Congressional testimony, Markopolos attributed the SEC's lack of adequate action to it having "too many attorneys and too few professionals with any sort of financial background" to understand his calculations (Bloomberg, February 4, 2009). This episode does not smack of regulators following any type of financial theory, let alone possessing the skepticism of Madoff's returns that is implied by a genuine belief in the EMH. See United States Securities and Exchange Commission, Office of Inspector General: *Report Of Investigation, Case No. OIG-509, Investigation of Failure of the SEC to Uncover Bernard Madoff's Ponzi Scheme,* August 31, 2009.

18. Thomas S. Kuhn, *The Structure of Scientific Revolutions*. 2nd ed. Chicago: University of Chicago Press, 1970. The *Times Literary Supplement* listed this work among "The Hundred Most Influential Books since the Second World War."

investors makes the value of the firm independent of and unaffected by differences in capital structure and financing policies generally. The CAPM states that, *given* the variance-covariance matrix of future returns and the pricing of two benchmark efficient portfolios, pure exchange among investors determines the risk-return relation. The Black-Scholes option pricing model states that, *given* the share price, price volatility, and several other variables, pure exchange among investors determines the price of an option on the share. These theoretical milestones all have been achieved at the expense of ignoring the real sector—that is, where the cash flows come from for discounting, what projects companies invest in, what determines security risk, and so on.[19]

As a consequence, when households suddenly decide to stop adding to the real housing stock, modern finance theory is silent about the implications. For example, the CAPM takes the riskless rate, market risk premium, and individual-security betas as given. But in the event of a large shock in a real asset market, what values of these CAPM parameters would be consistent with efficient pricing of securities? Most empirical tests of market efficiency typically avoid this issue, and implicitly assume that the observed values for riskless rates, market risk premiums, and betas are correct.

Real factors obviously matter but, by focusing almost exclusively on monetary exchange, modern financial theory has made its major breakthroughs by ignoring them. An equivalent problem is faced by those who assume the crisis originated in the financial sector and then spread to the real sector, reducing economic output and raising unemployment. Indeed, the popular term *financial* crisis takes this assumption as a given. My own view is that the problems originated in the real asset markets (chiefly in real estate), but was first *reflected* in the financial markets—precisely because those markets are more efficient. The general public might have first learned of the collapse in real asset prices from the credit market liquidity problems and widening spreads that emerged in the summer of 2007, or from the collapse of Bear Sterns or Lehman Brothers, or from the fall in stock prices generally. But that does not mean that the problems originated in, or were "caused by," the financial markets. They were just the proverbial canary in the coal mine.

In addition to these limitations of EMH that stem from ignoring the supply side of the information, there are a number of others worth noting:

• Information is modeled in the EMH as an objective commodity that has the same meaning for all investors. In reality, investors have different information and beliefs. The actions of individual investors are based not only on their own beliefs, but beliefs about the beliefs of others—that is, their necessarily incomplete beliefs about others' motives for trading. This likely becomes most important during periods of rapid price changes, such as October 1987. Unlike more stable periods, when an investor can wake up and read or listen to some thoughtful analysis of the prime movers of prices on the previous day, this kind of information is not available in a timely fashion during periods of rapid price change

• Information processing is assumed in the EMH to be costless, and hence information is incorporated into prices immediately and exactly. While it seems reasonable to assume that the cost to investors of *acquiring* public information is negligible, information *processing* (or interpretation) costs are an entirely different matter. They have received surprisingly little attention.

• The EMH assumes the markets themselves are costless to operate. Generally speaking, stock markets are paradigm examples of low-cost, high-volume markets, but they are not entirely without costs. This limitation raises the following conundrum: if there are pricing errors that are not eliminated because they are smaller than the transaction costs of exploiting them, is the market judged to be efficient—because of the absence of profits from exploitable errors—or inefficient—because of price errors that persist because of transactions costs? The role of transaction costs in the theory of market efficiency is unclear.

• Similarly, the EMH implicitly assumes continuous trading, and hence ignores liquidity effects. There is evidence that illiquidity is a "priced" factor—that is, higher returns compensate for lower liquidity—though how to measure liquidity is unclear.[20] Few would take the fact that markets are closed on weekends or overnight as a serious violation of market efficiency, but episodes of heightened illiquidity are another matter. Starting in the summer of 2007, illiquidity was an extremely important feature of many credit markets and real asset markets.

• The EMH also is silent on the issue of investor taxes. In reality, many investors pay taxes on dividends and capital gains, with some offsets for capital losses. The effects of investor taxation on security prices and expected returns are potentially large, but not well understood.

From the above, it should be apparent that the EMH adopts a simplified view of markets. To those who take theories literally—not as useful abstractions—the combined effect of these simplifications could well be to encourage a *deus ex machina* view of securities markets, as discussed above. But that is a problem of the musician, not the instrument.

19. The rare breakouts from pure-exchange thinking have provided important insights, notably the Jensen and Meckling proof that the Miller-Modigliani theorems do not hold with positive agency costs, because firms' investment decisions then depend on their financing policies. See Jensen, M.C., and W.H. Meckling, 1976, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics* 3, pp. 305–360.

20. Y. Amihud and H. Mendelson, "Asset Pricing and the Bid-ask Spread," *Journal of Financial Economics* 17 (1986), pp. 223–249. R.A. Korajczyk and R. Sadka, "Pricing the Commonality across Alternative Measures of Liquidity," *Journal of Financial Economics* 87 (2008), pp. 45–72.

3. There are limitations to tests of the EMH.

Many problems also arise in testing market "efficiency," including the following:

• Just as a test of the proposition "man is moral" requires an operational definition of what constitutes "moral," a test of efficiency requires a precise specification of what constitutes an "efficient" price response to information. Normally this is done by comparing the returns earned from trading on the information with the returns otherwise expected from passive investing. But implementing the "counterfactual" in this way suffers from what Fama describes as the "bad model" problem: we do not have a perfect theory of the returns to be expected from passive investment. Early empirical work relied on the Capital Asset Pricing Model to estimate expected returns, but it does a poor job of predicting returns on average: high beta-risk stocks cannot be shown to earn higher average returns than low beta-risk stocks. This finding could be caused by the CAPM being a bad model, or by betas being difficult to measure accurately; but either explanation causes problems in testing market efficiency. Later work employs the Fama-French three-factor model, which does a better job of predicting returns but is cobbled together based more on a foundation of empirical correlations than on solid asset pricing theory. Because tests of market efficiency are "joint tests" of the market's ability to incorporate new information in prices and a particular model of asset pricing, any flaws in the model affect the reliability of the test of efficiency.

• Tests of the EMH involve studying the flow of information into market prices. Many types of information could be expected to change—or at least not be independent of changes in—important asset pricing parameters such as interest rates, risk, risk premiums, and securities' risks. Consider the information contained in variables like Federal Reserve policy, tax rates, investor demographics, technological change, and labor productivity. We know little about how such variables evolve over time, or about the implications of their evolution for the time series behavior of expected returns in an efficiently priced market. Some of these variables will be subject to long-term secular change. For example, a secular aging of the population increases the ratio of retirees living off investment income to workers, and could bring about a secular decline in real interest rates. What sequence of aggregate (market-wide, or index) security returns would then be consistent with efficient pricing? Other variables will experience transitory shocks. As was made painfully clear during 2008, aggregate system-wide risk accelerates rapidly when correlations across asset returns rise. Investors are unable to diversify system-wide risk, so market indexes fall sharply to yield a substantially increased risk premium in the form of increased expected returns (that is, expected price reversals). What exact sequence constitutes an efficient price reaction? Was the size of the fall, and thus the size of the expected recovery, too large? Too small? The EMH is silent on these issues.

• At the individual security level, important parameters like risk are difficult to model and estimate. Risk is clearly not a constant. Companies, like market indexes, can be expected to experience occasional episodes of heightened uncertainty—for example, during periods of strikes, antitrust or other legal action, or major moves by competitors. Equity betas can be expected to change in response to changes in companies' stock prices, which cause changes in market-valued financial leverage. They can also be expected to vary with major announcements, including earnings. What level of risk makes security efficiently priced? Does the market over- or under-assess risk? Many research designs estimate and control for the realized, or *ex post* level of risk, with the implicit assumption that the observed level is the correct level. A similar observation can be made about securities' loadings on the three factors in the Fama-French model.

4. The real world is complex.

One of the important lessons from the global financial crisis is that the world is more complex than many thought, and certainly is more complex than many or most pricing models used in practice. Many derivative securities that PhDs in financial economics or physics were employed to model in one clean, crisp equation were discovered to be—in practice if not in theory—the creations of complicated legal documents. For many mortgage backed securities, it is difficult to sort out what the underlying cash flow rights of the investor actually are when defaults start occurring.

Did the simplicity of the models employed by researchers, from 1970 Fama's formulation of EMH through to specific pricing models, lull people into thinking that the EMH meant the same things as the models? Maybe. But one can't blame a *theory* for people misusing it. Every theory is an abstraction; no theory can be taken literally.

Anomalies, Behavioral Finance, and the Future of "Market Efficiency"

By now, it should be clear that anomalies in the theory of market efficiency abound. The long list includes price overreactions and excess volatility; price underreactions and momentum, particularly in relation to earnings announcements; seasonal patterns in returns; and the relation between future returns and many variables such as market capitalization, market-to-book ratios, price-earnings ratios, accounting accruals, and dividend yields.

No theory can explain all the data it is asked to explain: there are always anomalies. Only in the next world are we promised perfect comprehension. What is never totally clear is whether the market anomalies are due to imperfections in the markets themselves, imperfections in market efficiency as a way of thinking about how competitive markets behave, or defects in the research itself. One suspects the answer is (d): all the above.

Where does behavioral research come into this picture? In one sense, the "behavioralists" in finance merely jumped on the bandwagon that started when the early financial economists started observing and reporting anomalies. The first discussion of an anomaly in the market reaction to public information that I'm aware of is in my 1968 study with Philip Brown of the market reaction to earnings announcements. We observed that the market response to the announcements persisted for several months, a phenomenon that later became known as "post earnings announcement drift" or "earnings momentum."[21] By the mid-1970s this pattern had been observed in several studies, and I used Kuhn's word "anomaly" to describe it.[22] Basu's discovery of abnormal returns by companies with low P/E ratios was published in 1977, and Banz's finding of the same for small firms was published in 1981.[23] But the genesis of the behavioral finance literature is generally identified as the publication of two famous papers by Werner DeBondt and Richard Thaler, one in 1985 and the second in 1987.[24] Since then, behavioral research has succeeded in poking many more holes in the theory of efficient markets.

Has behavioral finance supplanted EMH as the prevailing theory of financial markets? The question assumes that it *is* a theory, as distinct from a collection of ideas and results. As I see it, the behavioral literature relies on the theory of efficient markets. By that I mean the following. A revealing fact is that the behavioral finance literature contains no references that I can find to anomalies *in behavioral finance*. I reviewed six compendiums of behavioral finance and searched all issues of the *Journal of Behavioral Finance* for references to "anomalies."[25] The only references I could find were to anomalies *in the theory of efficient markets*. Does the absence of reference to its own anomalies mean that behavioral theory is perfect?

Kuhn tells us that to discover anomalies one first must have a theory that is capable of being contradicted. One of the strengths of the EMH is its refutability: it can be tested. One gets the impression that behavioral finance, taken as a whole, consists of a set of disjointed and inconsistent ideas, some of which are rationalizations of the anomalies of others. If all theories are abstractions and all theories have anomalies, but behavioral finance has no anomalies, the implication is that it is not a theory.

However, behavioral finance does have its own anomalous evidence, even if it does not receive prominent treatment in its own literature. For example, it is a widely held belief among fund managers that it is easier to earn fees from selling and managing funds that trade on anomalies and behavioral strategies than it is to earn abnormal returns on the funds. Moreover, this belief was tested in a recent study of 16 mutual funds whose stated investment strategy is to trade on behavioral financial research ideas. In that study, Wright, Banerjee and Boney conclude that, while there is considerable variation across the funds, taken as a group they attracted more investment dollars than comparable non-behavioral managed funds, but without earning higher risk-adjusted returns (which were roughly the same between the two groups).[26]

None of the above is meant to detract from the contribution of behavioral financial research, which has widened our knowledge of how financial markets behave and has demonstrated major holes in the efficient markets theory. Nor does it imply that behavioral finance has replaced (or will replace) market efficiency as the fundamental construct underlying how we think about financial markets. Kuhn reminds us that anomalies abound in all theories, but we live with them if we find the theory useful: it takes a theory to beat a theory. Despite its limitations, the notion that prices efficiently incorporate information is an indispensable foundation for how we organize the world. Three examples can be used to illustrate this point.

The first example is the concept and method of discounted present value. There is no evidence that anomalous evidence for the efficient market theory has led to a wholesale abandonment of present value. It continues to be widely used in law, economics, business, finance and accounting. It underlies how we think about the value of income streams, and is used for valuation calculations in a variety of contexts.

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21. Ray Ball and Philip Brown, "An Empirical Evaluation of Accounting Income Numbers," *Journal of Accounting Research* Vol. 6, 1968, pp.159-178, discussion at pp. 173-174.

22. Ball, Ray, 1978, "Anomalies in relationships between securities' yields and yield-surrogates," *Journal of Financial Economics* Vol. 6, pp. 103-126.

23. S. Basu, "Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis," *Journal of Finance,* Vol. 32, No. 3 (June, 1977), pp. 663-682. Rolf W. Banz , "The Relationship between Return and Market Value of Common Stocks," *Journal of Financial Economics* Vol. 9 (1981), pp. 3–18.

24. DeBondt, Werner, and Richard Thaler, 1985, "Does the Stock Market Overreact?" *Journal of Finance* 40, pp. 793-805. DeBondt, Werner, and Richard Thaler, 1987, "Further Evidence on Investor Overreaction and Stock Market Seasonality," *Journal of Finance* 42, pp. 557-581.

25. Richard H. Thaler, editor, *Advances in Behavioral Finance* (New York: Russell Sage Foundation, 1993). Hersh Shefrin, editor. *Behavioral Finance* (Cheltenham, UK and Northampton, MA: Edward Elgar, 2001). Hersh Shefrin, *Beyond Greed and Fear: Understanding Behavioral Finance and the Psychology of Investing*. Andrei Shleifer, *Inefficient Markets: An Introduction to Behavioral Finance*. (New York: Oxford University Press, 2000). Edward. J. McCaffery and Joel Slemrod, editors. *Behavioral Public Finance* (New York: Russell Sage Foundation), 2006. Mark Schindler, *Rumors in Financial Markets: Insights into Behavioral Finance* (Chichester, England and Hoboken, NJ: John Wiley & Sons Inc., 2007).

26. See Colby Wright, Prithviraj Banerjee and Vaneesha Boney, "Behavioral Finance: Are the Disciples Profiting from the Doctrine?" *The Journal of Investing,* Vol. 17, No. 4, Winter 2008, pp. 82-90.

In another study, Chan, Frankel and Kothari conducted direct tests of behavioral hypotheses about investor biases in revising their priors in response to new financial information. Using historical stock return data, they simulated investment portfolios that trade on the different predictions implied by the two behavioral hypotheses. The study found no evidence to support Tversky and Kahneman's "representativeness" bias, and only weak evidence for Edwards' "conservatism" bias. See Chan, W., R. Frankel and S.P. Kothari, 2004, "Testing Behavioral Finance Theories Using Trends and Sequences in Financial Performance." *Journal of Accounting & Economics* 38, 3-50; A. Tversky and D. Kahneman, "Judgment under Uncertainty: Heuristics and Biases," *Science* 185 (1974), pp. 1124–1131; and W. Edwards, "Conservatism in Human Information Processing," in B. Kleinmutz, editors, *Formal Representation of Human Judgment*, Wiley, New York (1968).

Yet the present value rule is a very strict application of the Law of One Price, a fundamental economic principle that states: "In an efficient market all identical goods sell for an identical price." In the words of Lamont and Thaler, this principle "is the basis for much of financial economic theory."[27] The present value rule assumes that the discount rate—that is, the price per dollar of a cash flow at a future date—is independent of the amount of the cash flow, its sign (inflow or outflow), and the way it is packaged with cash flows at other dates—for example, as part of a multi-period financial instrument or a long-term investment project.[28] That is, it states that there is one price for future money, no matter how it arises. The rule assumes efficient pricing, and it has not been abandoned presumably because it is a useful—though clearly not a perfect—guide for our thinking and calculations when valuing assets, liabilities, and entire companies.

The second example is the legal theory of "fraud on the market" that underlies the majority of U.S. securities class action fraud cases. This legal theory states that investors trading in an efficient market are implicitly relying on stock prices that are assumed to incorporate all public information. Because of this assumption, individual plaintiffs do not have to prove that they directly received and relied on the false information they allege was fraudulently provided; instead they are assumed to have indirectly relied on such fraudulent information when they traded at a particular market price that incorporated it.[29] In some respects, behavioral financial theory is inconsistent with this legal theory, but it is difficult to see how it could replace it.

The third example is the use of market prices for valuation purposes in a wide variety of contexts. Consider the daily calculation of net asset values (NAVs) of shares in mutual funds. Fund NAVs are based on the prices of the securities in which the fund is invested. The "fair value" of each security is determined daily, and aggregated across securities to determine the fund's NAV—and as the price paid and received by investors buying and selling fund shares, the NAV is an important calculation. If it is traded on a liquid market, the closing price of a security (or the price from the most recent trade) is normally taken to be its fair value.

But now consider what often happens when securities are traded in low-volume emerging markets, in which the last trade price may well be "stale." If the market index has fallen since the last trade, the price at which it last traded is often adjusted downward to an estimated fair value, with the aim of treating investors buying and selling fund shares fairly. This kind of adjustment of the last trade price can be viewed as consistent with EMH in the sense that, as discussed earlier, the theory is silent on questions of liquidity.

What we do *not* observe in practice is more illuminating. We do not see prices being adjusted downward by large amounts during asset bubbles because they are wildly in excess of fair values, or upward during troughs. This is not the practice of banks, investment banks, insurance companies, private equity funds, mutual funds, or in any context in which market pricing is important. There does not seem to be a market for an adjusted index fund that makes anti-cyclical price adjustments, subtracting from prices at the peak and adding at the trough. There does not seem to be any legal support for the argument that because prices prove to be too high at the height of bubbles, and so unfairly advantage those who sell mutual fund shares over those who buy, the prices themselves should be adjusted substantially downward. My conjecture is that investors and courts would not trust the fund management to know *ex ante* when they are at a peak or at a trough.

In other words, as a practical matter bubbles may only exist in hindsight. Contemplating the fanciful nature of the counterfactual helps us to understand why the practice of relying on actual security market prices is so entrenched in commercial practice, in law, and in regulation. They are "efficient" enough, despite anomalous evidence against the EMH. When push comes to shove, what is the practical alternative?

Closing Thoughts

Fama's 1965 insight—combining simple competitive economic theory with an information-based view of security prices—irreversibly changed the way we look at financial markets. Like all important insights, this is the case even if it is not a complete representation of how markets behave. The impact of the theory of efficient markets has proven to be durable, and seems likely to continue to be so, despite its inevitable and painfully obvious limitations.

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27. Lamont, O.A. and Thaler, R.H. (2003), "Anomalies: The Law of One Price in Financial Markets," *Journal of Economic Perspectives* 17 (Fall 2003), pp. 191-202, at page 191.

28. For example, see Thomas S. Y. Ho and Sang Bin Lee, The Oxford Guide to Financial Modeling Applications for Capital Markets, Corporate Finance, Risk Management and Financial Institutions (Oxford: 2004), page 54.

29. See *Basic Inc. v. Levinson*, 485 U.S. 224 (1988).