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What is the Alternative Hypothesis to Market Efficiency?

BRADFORD CORNELL
CALIFORNIA INSTITUTE OF TECHNOLOGY
SMBPLLC
bcornell@caltech.edu

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All happy families are alike; each unhappy family is unhappy in its own way.

Leo Tolstoy, Anna Karenina

On repeated occasions, Eugene Fama has claimed that critics have failed to offer a complete alternative to the efficient market hypothesis (EMH). More specifically, in his Noble speech, Fama said, "Most important, the behavioral literature has not put forth a full blown model for prices and returns that can be tested and potentially rejected – the acid test for any model proposed as a replacement for another model." Here I argue that Fama's complaint is too strong. The EMH can fail and there still be no model that meets Fama's criteria. This short paper explains why and offers a more reasonable alternative to the EMH based on the viewpoint that behavioral biases, though common, are state dependent.

The foundation of the EMH is the assumption that investors are rational utility maximizers. The rationality assumption depends on neither time nor circumstance – it is not state or investor dependent. As argued below, this is not true of the alternative hypothesis.

The behavioral response to the EMH has two aspects both of which are related to the underlying assumption of rationality. One, behaviorists point to market anomalies that the EMH cannot explain. Two, behaviorists cite an extensive empirical literature in both psychology and economics which demonstrates that individuals commonly violate the assumption of rational decision making. Leveraging off these two foundations, the typical behavioral response to market efficiency proceeds in a fashion similar to that laid out in the original path-breaking behavioral papers such as DeBondt and Thaler (1985). First, the authors begin by identifying a particular market anomaly. For example, DeBondt and

Thaler find that when stocks are ranked on 3- to 5-year performance, past winners tend to be future losers and vice versa. Second, the papers propose a mechanism, often a complex mechanism, involving the interaction between rational investors and investors subject to some type of behavioral bias. In the case of DeBondt and Thaler, they hypothesize that investors over-react to recent information. That is, in forming expectations, investors give too much weight to the past performance of firms and too little to the fact that performance tends to mean-revert. DeBondt and Thaler claim that such behavior is predicted by the behavioral decision theory of Kahneman and Tversky (1982). Third, assuming that there are limits to arbitrage of the type described by Shleifer and Vishny (1997) that prevent rational investors from setting prices, a pricing model is derived that demonstrates how the behavioral bias affects prices in equilibrium. Finally, the model is tested and found to offer an explanation for the anomaly. For instance, DeBondt and Thaler present evidence to show how the over-reaction to past performance is consistent with the pricing anomaly they identified.

As early as 1998, Fama (1998) offered three telling criticisms to the behavioral models that had proliferated by that point. First, he observed that the models tended to be fragile in that they explained the anomaly they were designed for but little else. More specifically, he noted that if investors behaved in the manner proposed such behavior would have implications beyond the specific anomaly the model was designed to explain. Fama observes that those other predictions are rarely developed and tested, and when they are the models are often found wanting. Second, when taken as a group the models contradict each other. For instance, some are based on overreaction while others are based on underreaction. Third, investors subject to the behavioral biases don't learn. Such learning

does not have to consist of understanding the error of their ways and becoming more sophisticated investors. It could amount to realizing that their performance is poor and moving to a passive strategy.

Fama's criticisms are well taken if the behavioral alternative to market efficiency is understood to be a model that relies on a persistent bias. It is hard to imagine how such a bias would fail to be eliminated, if not by direct learning on the part of those who underperformed, then by the investment innovations of which passive investing and exchange traded funds are two examples. But the situation is different if irrational behavior is state and investor dependent. If each specific incidence of irrationality depends on time and circumstance, then irrationality can persist and have a continuing impact on prices, but in a manner that changes from state to state. Furthermore, the extent to which an incident of irrationality affects particular investors is state dependent as well. Although it is common in behavioral research to divide the market into rational investors and those affected by behavioral biases, there is no reason to believe that the division remains the same in every instance. Investors with an irrational love for Tesla may be entirely different than those affected by the run-up in housing prices.

It is tempting to treat bubbles and crashes that occur at different points in time as if they were part of a homogenous group because, by definition, they are all characterized by dramatic moves in price relative to perceived estimates of fundamental value. But if instances of irrationality are state dependent this is a mistake. Attempting to find a mechanism which explains them all, or even a reasonable fraction of them, is doomed to fail because each bubble and crash depends on the facts and circumstances of the case at hand.

For this reason, when Fama argues that a behavioral theory must offer a "full blown model for prices and returns" he is setting an impossible standard. There *cannot* be a behavioral model for prices and returns precisely because the irrationalities that people exhibit are state dependent. Because circumstances are constantly changing, so are the potential irrational responses. The alternative to market efficiency, therefore, is not a timeless behavioral model but the viewpoint that human irrationality will cause departures of price from value, but that those departures cannot be separated from realized states of the world. Furthermore, the state dependency of irrational behavior is reinforced to the extent that stock returns are fundamentally nonstationary as described by Cornell (2018).

The pricing of Tesla provides an example. Accept for the sake of argument the conclusions of Cornell and Damodaran (2014) and Cornell (2016) that the run-up in Tesla stock from about $32 to approximately $350 cannot be explained by fundamentals and must, therefore, have an aspect of a bubble. The viewpoint advocated here is that the irrational behavior that produced the bubble is largely unique to Tesla - involving a combination of the introduction of a new product, very clever marketing, and an almost messianic belief in the power of Elon Musk to transform the automobile market. There is no reason to believe that the facts and circumstances of Tesla: the emerging impact of electric cars and the charisma of Elon Musk, applies to any other company or at any other time. Similarly, previous bubbles in the prices of other stocks are likely to be of little use in understanding the pricing of Tesla.

Though bubbles and crashes are state dependent, the work of Grossman and Stiglitz (1980) implies that irrational pricing must occur on a regular basis. Grossman and Stiglitz point out that if the market were fully efficient even the most sophisticated investors could

not profit from their investment in fundamental research and would refrain from the activity. But if there were no fundamental research, prices would diverge commonly and significantly from value, producing an incentive to do research. Accordingly, in equilibrium markets must be sufficiently inefficient that at least astute investors can earn a fair return on their investment in research. For this to be the case, there must be at least small "bubbles and crashes" that cause stock prices to diverge from fundamental value sufficiently so that they can be exploited by astute investors.

If the causes of state dependent bubbles and crashes are highly diverse and occur at random times, as is claimed here, then the law of large numbers implies that they will appear as noise. In fact, following Black (1986) noise can be thought of as nothing but the result of a constant barrage of small bubbles and crashes that occur when investors trade for reasons other than a rational assessment of fundamental value.

The hypothesis that bubbles and crashes are every day occurrences is also consistent with the classic experimental results of Smith et. al. (1988, 1993). Smith et. al. find that even in controlled laboratory experiments, where the information structure has been designed to reduce their probability, bubbles and crashes are the rule rather than the exception. Furthermore, the bubbles and crashes introduce noise into prices compared to the nonstochastic behavior of fundamental value in the experiments.

To be fair, Smith et. al. did find that if they repeated an experiment several times with the same participants, learning did occur and both the frequency and magnitude of bubbles and crashes were diminished. However, that learning was based on exact replication of the same stochastic experiment. In the actual capital market, exact states of the world never reoccur, so Smith's original results are more applicable.

The claim that bubbles and crashes are caused by irrational behavior that is state dependent does not mean that they apply only to individual companies. Once again it depends on the facts and circumstances. If the bubble is associated with an industry wide phenomenon, such as the belief that internet technology will revolutionize the economy, it is likely to affect an entire sector. If the bubble is associated with one unique personality or product, it is more likely to affect only one company. Because individual companies can be affected by many things that do not affect entire industries, bubbles and crashes should be more commonly observed there.

In short, both theory and evidence support Smith's experimental finding that bubbles and crashes, at least small ones, must be, and are in fact, the rule rather than the exception. The debate, therefore, should not be over whether stock markets are characterized by bubbles and crashes, but how frequently those bubble and crashes become large enough that they cause price and value to diverge significantly. That is an empirical question.

To conclude, Fama has set an unfair standard by calling for a behavioral alternative that offers a "full blown model of prices and returns." Unlike rationality that is the same everywhere, irrationality is state dependent both over time and across investors. Therefore, mispricing will be a consistent feature of financial markets, but because the irrationality that causes it varies over time and across investors, it will simply appear as excess noise. Unfortunately, there is no way that a full blown model of prices and returns can be based on such noise, but that does not mean that irrationality is a rare or unimportant aspect of financial markets.

The alternative hypothesis also has investment implications. Investment strategies that rely on persistent bias should be treated with suspicion. A example is the small firm effect. If it were based on behavioral bias, Fama is right in arguing that once it is recognized it should be exploited and eliminated. Of course, it is devilishly difficult to determine if such effects are examples of inefficiency because any test of asset pricing is a joint test of efficiency and model used to adjust for risk. The point here is that alternative hypothesis implies that the far more common instances of mispricing will be company specific, akin Tesla, that involve state specific instances of irrationality. Unfortunately, the only way to exploit such mispricing is by having the skill to uncover it via detailed fundamental analysis on a security by security basis.

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