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Behavioral Science is Wonderful to Be Sure: But is it Scientific, Too?

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ABSTRACT

Behavioral finance is touted as, among others, a scientific approach to investment which combines psychology and economics, and investigates the consequences in markets when some of its participants display not logically perfectly-informed risk-averse utility-maximizing behavior, but instead act like actual human beings. Two questions are considered: (1) "What does the science of behavioral finance imply about the behavior of stock prices?"; and also (2) "Are the predictions that behavioral makes about the behavior stock prices scientific?" This is a thought piece organized around these two questions. Using Popper's framework that scientific hypotheses require falsifiability, we conclude that behavioral finance is only falsifiable (and thus "scientific") in a limited sense.

Keywords: Stock market, investment strategies, falsifiability, behavioral finance

INTRODUCTION

The advertisement was intriguing, something rather like: "our mutual fund leverages the science of behavioral finance (BF) to deliver superior risk-adjusted returns". I looked through their top 10 holdings, declared them to be "eclectic" although without discerning any particular pattern (much less an investment strategy that they would imply) and this, in turn, generated some questions:

- "What does the science of behavioral finance imply about the behavior of stock prices?"; and also
- "Are the predictions that BF makes about the behavior of stock prices scientific?"

This is a thought piece organized around these two questions.

THEORETICAL BACKGROUND: FALSIFIABILITY

According to Karl Popper, a theory is only "scientific" if it can be falsified by evidence [1]. For example, he contrasts Freudian psychology with Einstein's theory of general relativity, considering the latter to be scientific and the former not. Popper described the total solar eclipse of 1919 as an opportunity to test a key prediction implied by general relativity and, to the surprise of many, the observed data fit its predictions rather than those of classical Newtonian mechanics. Moreover, had the observed data been different, the theory of general relatively would have been proven false as stated, implying at the very least the need for revisions to take the new experimental evidence into account. On the other hand, Popper argued that, regardless of the other merits it might possess, Fruedian psychology wasn't scientific, because any particular observation about human behavior could be interpreted in light of that theory, and a prediction made after the fact, albeit not necessarily before.

As practiced by those economists who study the stock market the default theory, analogous to classical mechanics in the example above, is the Efficient Market Hypothesis (EMH). Without making distinctions between the various forms of the EMH (i.e., weak, semi-strong, strong), for

the present purposes the key point is that the EMH makes a prediction about the behavior of stock prices, essentially that "no investment strategy can systematically generate significant excess risk-adjusted returns" [2]. This is a testable hypothesis, and could be falsified by the identification of an investment strategy which does consistently generate significant excess risk-adjusted returns, and thus by Popper's criterion the EMH is "scientific". Indeed, Popper describes every "good" scientific theory as a prohibition which forbids certain things to happen, with the more things forbidden the better. Using this working definition, the EMH is very "good" indeed.

The way that economists typically test alternative theories to the EMH is to use the new theory to derive an investment strategy, codify that strategy in such detail that it can be tested using a historical database, estimate risk-adjusted returns, and determine whether those returns exceed a benchmark implied by the EMH. One example of an investment strategy which could be tested by more or less any historical database is the strategy of purchasing stocks whose price increased by 100+% during the previous year. If the historical database also contains company-specific information such as earnings, investment strategies such as buying all stocks whose earnings grew by 50+% during the previous year could additionally be tested.

The correspondence between the version of an investment strategy that can be defined specifically enough to be codified as an algorithm and how that strategy would be implemented by actual investors isn't necessarily strong. For example, suppose that the strategy being tested is to buy all stocks with a dividend yield of 5+%. An actual "dividend investor" wouldn't buy every stock with a dividend yield of 5+%, but instead might use that criterion as an initial screen and then perform a more comprehensive analysis of the prospects for dividend sustainability and growth. This implies that the what is being tested is a weaker version of the investment strategy in question, and also a corresponding bias toward the null (and in favor of the EMH). Another bias toward the null is induced by keeping the investment horizon fixed [3].

Although outside the scope of the current discussion, it can be briefly noted that the evidence against the EMH is mixed. In general, a "momentum" strategy which assumes that stocks which have performed well (or poorly) during the last 3-12 months will continue to do so during the next 3-12 months produces excess risk-adjusted returns [4], as do "value" strategies which buy stocks with low price-earnings ratios [5], among others. The outperformance in question tends to be modest rather than dramatic, the technical details of how risk adjustment was performed are always open to debate, and the overall consensus seems to be that: (1) the EMH is often a sufficient approximation to the behavior of the stock market, which in turn is a rough approximation of a theoretical "perfect market"; and (2) nevertheless, some strategies have the potential to demonstrate outperformance. If the debate is framed as "EMH versus BF" there is fodder for both sides.

WHAT IS BEHAVIORAL FINANCE?

The above describes how the EMH can be tested. The same question can be asked about BF. This, in turn, requires answering the question: precisely what does BF predict about the behavior of stock prices?

To understand what BF might predict about the behavior of stock prices some background about BF is in order. In general terms, BF integrates insights from psychology and economics, especially concerning human judgment and decision making under uncertainty. As applies to investing in stocks, BF investigates the consequences in markets when some of its participants display not "logical perfectly-informed risk-averse utility-maximizing behavior", but instead

act like actual human beings.

In brief and over-simplified form, some of the tenets of BF as applied to the behavior of individual investors include the following [6-11]:

- *Investors manifest the cognitive bias of overconfidence.* For example, because they overestimate their ability to predict the future, they underestimate risk.
- *Investors manifest the cognitive bias of regret aversion.* For another example, it hurts so much to miss the next Google that they will overestimate the value of a "bright shiny object" that might be "the next big thing".
- *Investors manifest the cognitive bias of loss aversion.* Losing the same amount of money brings less pleasure than gaining it, an implication being that investors won't sell losing stocks when they should.
- *Investors manifest the cognitive bias of anchoring.* For example, they wrongly assume that the past behavior of a stock is a strong predictor (i.e., anchor) of its future behavior. As another example, they gravitate to mutual funds which have been particularly profitable in the past, even though this performance is unlikely to be repeated in the future, and even if those funds have a fee structure which is punitive.
- *Investors manifest the cognitive bias of hyperbolic discounting.* For example, they underestimate the benefits of the compounding of moderate returns for long time periods and thus behave more speculatively by trying to achieve unrealistically large gains in the short term.
- *Investors manifest the cognitive bias of the availability heuristic.* For example, they underestimate the probability of disaster ("black swans") because such disasters are difficult to visualize.
- *Investors use simplified heuristic decision making rules when faced with complicated situations.* For example, an investor might only focus on the dividend yield, without considering its sustainability.
- *Investors are affected by how issues are framed.* Among others, this implies a susceptibility to advertisements from the financial media.

The evidence in support of the various elements of BF is based upon a number of experiments – some more realistic than others and many extending outside the realm of stocks – which when considered as a whole are quite coherent [12]. This isn't even to mention that the above tenets also correspond to one's observations about actual people and, assuming a sufficient degree of introspection, of ourselves as well.

Moreover, BF has a plausible explanation for why humans exhibit the above biases: evolutionary biology. As an example, BF also holds that investors tend to overreact to events and see patterns even when they don't exist. The "creation story" associated with these tendencies is that our ancestors who postulated the correlation between rustling in the grass and the presence of a tiger, and thus ran for their lives, tended to survive while others didn't (even when most of the time the rustling in question was just the wind).

WHAT DOES BEHAVIORAL FINANCE PREDICT ABOUT THE BEHAVIOR OF STOCK PRICES?

Here, it is important to distinguish between two separate notions; (1) what irrational behavior does BF predict about the behavior of stock prices; and (2) why will that behavior, once identified, continue to persist. In doing so, we can't necessarily assume that the predictably irrational behavior of individuals will necessarily lead to similar patterns of irrationality within the market as a whole. Indeed, the EMH allows that investors can be irrational as individuals yet rational in aggregate – the same thing might potentially apply to BF as well.

In considering these questions, it is important to understand who sets stock prices. One investment adage states that "in the short run prices are set by emotion (i.e., speculative considerations), but in the long run prices are set by earnings (i.e., investment considerations)". BF attempts to explain the behavior of stock prices in the short run (i.e., the time frame during which predictably irrational behavior will occur). The people who set prices in the short term are large speculators – for example hedge fund managers, actively trading institutional investors, and the like. Indeed, once of the reasons that the stock market isn't a perfect market is that in a perfect market all participants are price takers, whereas in the equity markets very large investors effectively set prices. In the long run this price setting behavior corresponds to economic logic, whereas in the short run this price setting behavior has a significant speculative component.

The recognition that, in the short term, stock prices are effectively set by a relatively small number of individuals is the link that allows us to plausibly assume that the research on the behavior of individual investors might also extend to the behavior of stock prices.

Perhaps the most fundamental assertion that BF makes about the behavior of stock prices is that investors overreact. More specifically: BF predicts that those investors whose actions set stock prices overreact. Extreme forms of overreaction occur during bubbles and panics, during which positive feedback loops are temporarily formed which accentuate the phenomenon. As a less extreme manifestation, overreaction helps explain the momentum component of the *pas de deux* between momentum and value, whereby emotion-based momentum temporarily moves prices out of alignment with true values and then economic considerations eventually induce a regression toward the mean.

BF also suggests a general prediction about where bubbles are most likely to form – namely, in the investment equivalent of "attraction to a bright shiny object" (a construct which is also consistent with evolutionary biology) such as a new idea or a new industry, cryptocurrency being a recent example. The same general prediction also applies in reverse – the more pedestrian and uninteresting the industry, the more likely that prices will be depressed (in both meanings of the term).

CRITIQUE

BF has much to recommend it as a descriptive explanation of the behavior of stock prices. BF explains momentum in stock prices and, economic reality eventually predominating, the predictable counter-reaction to that momentum. Overreaction to short-term events among large speculators (and the anticipation of such events) helps explain the excessive short-term volatility in stock prices, a level of volatility which is out of proportion to traditional economic logic. Indeed, BF successfully explains the most salient characteristics of the behavior of stock prices.

Despite "explaining everything" BF also "predicts nothing" – more precisely, the predictions which BF generates aren't unique (and, at times, can be contradictory). For example, BF doesn't predict when momentum will push a stock's price so far out of balance that a reaction will take place. Nor does BF predict where and when any particular bubble will appear, only that the bubble will likely be associated with a bright shiny object. Indeed, recognizing that an eventual counter-reaction is the final stage of momentum, and thus is consistent with BF, on encountering a stock which is exhibiting price momentum BF could simultaneously predict that this stock will outperform the market because of continuing momentum and also that this stock will underperform the market because of the eventual counter-reaction. Because BF generates opposite hypotheses, and similar to Freudian psychology in Popper's example, any

conceivable pattern of price data will be consistent with one hypothesis or the other, and thus BF is neither (fully) falsifiable nor (fully) scientific.

Returning to the analysis of historical databases, what BF can do is to provide the logic which underpins the investment strategies to be tested when attempting to falsify the EMH. For example, a rough statement of the BF-based logic behind a "value-based" strategy is that investor over-reaction (more specifically, over-reaction among the relatively small group of investors whose actions set prices in the short term) causes some stocks to become temporarily overvalued and others to become temporarily undervalued, relative to traditional economic benchmarks. A strategy which selects economically undervalued stocks should eventually outperform the market, because of the predictable regression toward the mean of stock prices.

As another example, a rough statement of the BF-based logic behind a "cyclical" strategy is that investors (more specifically, those who set prices in the short term) manifest a cognitive bias when valuing cyclical companies – that is, those companies whose earnings dramatically rise and fall depending on the economic cycle. From the perspective of economics, so long as the companies in question are in little danger of going bankrupt during the low point of their economic cycle (i.e., and noting that different industries bottom out at different points in the overall economic cycle) the true economic value of the stocks in question should remain unchanged throughout the entire economic cycle – for example, the true value might be based upon the aggregate earnings across this cycle, annualized. However, the cognitive bias which gives undue attention to recent events instead causes investors to overvalue cyclical companies when earnings are good and undervalue cyclical companies when earnings are poor. A strategy which selects cyclical companies at the point when their earnings are performing particularly poorly should eventually outperform the market, because the current price is below true economic value and this is a discrepancy which will eventually be resolved.

Considering all this, what BF <u>can</u> potentially do is to inspire investment strategies whose performance might cast doubt on the strongest and most literal versions of the EMH (and, in doing so, perhaps also suggest how the EMH can be fine-tuned). The premise that a specific investment strategy, inspired by BF, will outperform the market on a risk-adjusted basis is directly testable (and falsifiable), and the thus theory that such an investment strategy will outperform the market is "scientific". What BF <u>cannot</u> do is to be proven false in its entirety, as discussed above. In this sense, then, the BF is not "scientific".

WHY MIGHT THE "IRRATIONAL" PRICE BEHAVIOR PREDICTED BY BEHAVIORAL FINANCE CONTINUE?

One additional consideration merits discussion. As the old joke runs: two economists are walking down the street and one of them notices a $100 bill. The first explains to the second that the bill can't actually be there, because if it were someone would have already picked it up. By analogy, it can be asked of the proponents of BF: "If overreaction is so predictable, why don't those same market participants who set short-term prices take advantage of it, make tons of money in the process, and in doing so create an arbitrage which also makes the opportunity in question disappear?" Seemingly, the proponents of BF would respond: "Because they can't help themselves – it's evolution you know." To which one might reply: "Really? With all that money to be made no one can help themselves?"

We believe that the explanation for this phenomenon is far more mundane [13]: "It is difficult to get a person to understand something, when his salary depends upon his not understanding it." An entire industry exists around the notion – quite likely false – that short-term

speculation is (net) profitable. This industry includes much of the financial media, and plenty of people would be out of work if the premise that short-term speculation is profitable were seriously explored rather than blissfully assumed. We argue that, in the short term, stock prices behave as if investors over-react, and the reason that they do so is that the people who effectively set those prices over-react, and moreover they do so not necessarily because of economic logic, or because evolution has hard-wired them to do so, but simply because it is in their personal best interest to do so.

Indeed, if (relatively) permanent, predictable and exploitable inconsistencies are to be found in the behavior of the stock market, the most likely candidate for the root cause of those inconsistencies is a structural feature whereby participants who set prices also have personal incentives which are inconsistent with long-term economic value.

CONCLUSION

In conclusion, using Popper's framework of falsifiability, despite its value in describing and explaining the behavior of investors, BF as a whole isn't "scientific", because it doesn't generate unique and testable (i.e., falsifiable) predictions. However, specific investment strategies consistent with BF are testable, and thus "scientific".

AFTERWARD

Returning to the advertisement for the mutual fund, and in view of all of the above, what might I as a potential customer think? My first thought might be positive: namely, that the fund managers are self-aware, are endeavoring to transcend their evolutionarily-based flaws in thinking, and might do well. My second thought might be that I can ignore the dogma from Econ101: namely, that any exploitable inconsistency in a perfect market can't last because, once identified, it will be removed through arbitrage. Instead, because of the role that personal incentives play for those who set stock prices in the short term, I would instead be convinced that the exploitable inconsistency in question won't disappear any time soon.

After these positive thoughts might come, if not necessarily doubts, then at least some qualifications. In particular, while it is true as advertised that there is a science of BF, and that science is supported by evidence, the link between the science of BF and what the fund managers will do isn't airtight. In fact, what the fund managers will do is apply one of many investment strategies consistent with BF, recognizing that the evidence in favor of the general principles of BF is strong and the evidence suggesting the outperformance of any particular investment strategies isn't. Thus, at the end of the day what I will care about isn't really BF, but instead is my degree of comfort with the investment strategy being followed.

In the spirit of being a thoughtful customer, my review of the advertisement might include two additional considerations. First, I would aggressively discount claims of previous superior risk-adjusted performance, recognizing that, in most cases, such performance is primarily due to luck [14]. Second, I would carefully examine the fee structure, as one of the most consistent findings of the literature is that high fees associated with active management benefit the manager but not the customer [15]. Indeed, the thought might occur to me that I could achieve a fee of $0 by simply implementing the management strategy in question on my own.

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