[Un]Emotional Investing

A Case for Modern Algorithms

Executive Summary

There is no fear in the market, only anxiety. The popular CBOE Volatility Index (VIX) should no longer be called the "Fear Index" and instead should more accurately be described as the "Anxiety Index." The distinction between fear and anxiety is an important one because our brains do not equip us with cognitive tools which can adequately separate the two in a meaningful way. Research shows that the human brain thinks by emotion first and rationale second, and the hierarchy negatively affects investor's rates of return.

Furthermore, we provide evidence that individual investors significantly underperform their benchmark in aggregate, and propose that creating a rules-based system to replace emotional decision-making is the best way to increase a probability for reaching any desired result. Algorithms have been around for thousands of years, and we show that they are the best candidate for modern utility when creating a rules-based investment strategy.

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Anxiety is not fear...

There is no fear in the market. Most financial programs on TV and articles in newsprint speak of fear. Fear is when you are hiking in the woods, and a Grizzly bear steps out on to the trail ahead of you. The immediate influx of adrenaline, quickening breath, spike in cortisol, dilation of pupils, slowing of digestion, decrease of saliva. That is fear. The true fight or flight, amygdala-based response. The market or better put perhaps, the people who are investing in the market, are not feeling fear when the market experiences extreme volatility. Investors in the market are experiencing anxiety. Whereas fear is the unequivocal human response to a direct threat, anxiety is an ongoing response to what might happen. To use the earlier example, if a bear steps out on to the trail ahead of you, you feel fear. If you are hiking in the woods and you are worrying that you might see a bear, you are feeling anxiety. The people in the market, including experienced traders, fund managers, and investors are experiencing what might happen in the market in response to a seemingly unlimited supply of information. It is the uncertainty and lack of control that is causing the reaction on a day to day basis in the market. You may argue that when the market drops 1000 points in a day, it is exactly like staring at a Grizzly bear on the trail in front of you. It is not. There is no immediate threat to your life, which is why fear and the anatomical responses to fear, are hardwired in the human brain.

To stay alive as a species, humans had to have an urgent answer to those things that may want to harm them. What we term fear had to be a part of the human brain. Anxiety is hardwired in much the same way but for a slightly different reason. If humans didn't have anxiety about where their next meal was going to come from, they would eventually starve to death. Hunting for game and scouring the countryside for food each day is a direct response to the anxiety that if they didn't find food they would perish. "Anxiety keeps us cautious and attentive to the possibility of physical or social harm" (Buss, 2015). In this sense, anxiety was healthy and as important as the fight or flight response. Neuroscientist Joseph LeDoux says "Where fear is a response to a present threat, anxiety is a more complex and highly manipulable response to something one anticipates might be a threat in the future. It is worry about something that hasn't happened and may never happen" (Strauss, 2016).

Doug Lennick, CEO and Co-Founder of think2perform, is a behavioral finance expert. He says that it takes information 12 milliseconds to reach the amygdala or emotional center of the brain and it takes 40 milliseconds to reach the cerebral cortex or logic center of the brain. Three times as long. This means that humans are emotional thinkers first, logic thinkers second (Lennick & Kiel, 2011).

The premise of this paper is to state that anxiety was good for the success of the human population but is terrible for the success of people investing in the stock market. Humans think emotionally first and logically second. Successful investing is very difficult when anxiety is stuck in the "on" position. Perhaps the best way to begin to explain this is to start at the beginning.

Scientist theorize that 75,000 years ago a cataclysmic event happened that nearly wiped out the human race. The Toba Super-eruption was a colossal volcanic eruption in what is in present-day Indonesia. The theory states that the eruption caused a 10-year volcanic winter and possibly a 1,000-year cooling of the earth. These events may have created a genetic bottleneck that left the human population numbering between 3,000 to 10,000 (Dawkins, 2004). As of 2017, it was estimated that the current population of the earth is 7.53 billion souls. So, how does any complex organism increase from thousands to billions in such a short amount of time? Plausibly, to grow in that amount of time would require the entity to bite, claw, scratch and fight to stick around. It would also require the brain to adapt to a complex survival scheme to avoid extinction. The constant battle with the elements, predators, disease, hunger, thirst, and natural disasters made survival a daily ordeal (Javanbakht, 2019). That ordeal forced the brain to adapt to its environment and develop coping mechanisms, such as fear and anxiety, that would give it the best chance for survival. Those same adaptions and coping skills are operational in the 7.53 billion people living today. Unfortunately, those coping strategies in the brain that helped humans survive 75,000 years ago may not serve people well in the modern environment. Today, humans are dealing with a constant deluge of information at their fingertips.

News from all over the world can be seen in an instant. Usually, the news is not good, and the reasons for that seem to be of our own making.

Hans Rosling, a medical doctor, professor and World Health Organization advisor, found after years of testing people throughout the world that people have a built-in negative world view. “People have an overdramatic worldview. They constantly and intuitively refer to their worldview when thinking, guessing, or learning about the world. My experience, over decades of lecturing, testing, and listening to the ways people misinterpret the facts even when they are right in front of them, finally brought me to see that the overdramatic world view is so difficult to shift because it comes from the very way our brains work” (Rosling, Rosling, & Ronnulund, 2018, p. 14). While the media may be blamed for sensationalizing the news they put out, it may be safer to say that humans demand these types of stories. Humans are drawn to bad news more than good news, and this has been demonstrated in all of the countries that Rosling tested (Rosling et al., 2018). “The human mind, scientists contend, is built for belief. When you picture or hear of something, you assume it is true. Our ancestors evolved in an environment too dangerous to question themselves every time they thought they saw a lion or second-guess every story from a tribe member” (Hutson, 2019, p.61). Before news from around the globe was so readily available, people learned to receive small, containable information about their village, town or city. These days, if something unfortunate happens in Bangladesh, the news is seen in Los Angeles and felt as if it was happening in Los Angeles even though the event took place thousands of miles away. “People have a tendency to over-personalize risk and to experience an unrealistic sense of peril when we hear or read of a bad event occurring to someone else” (Siegel, 2005, p. 36).

Additionally, humans have poor memory systems. False memories have always been a part of how the brain stores information. However, the technology of today, has created an incredibly fast and sweeping system in which to deliver information. Much of that information is slanted, biased, or plain invented which creates a cognitive environment in which our “memories have not evolved to win” (Hutson, 2019, p. 62).

It is incredibly difficult for people to “unsee” information. Even if the subject knows that they are seeing a fake or copy the brain creates memories that can be brought up at a later time and remembered as fact. “Memory can morph figurative and fantasized images into concrete-seeming pasts” (Hutson, 2019, p. 64).

How then does someone invest in the stock market for the long term with so much emotion, anxiety, bad news, poor memories and “overdramatic worldview” hampering them? The short answer is that they cannot. There are always a few exceptions to the rule, but most people in the aggregate are too emotional and anxious to be good investors. They have emotional bias’ that undermine the investment process. Loss aversion is one such bias. This was first demonstrated by psychologists Daniel Kahneman and Amos Tversky. “When directly compared or weighted against each other, losses loom larger than gains. This asymmetry between the power of positive and negative expectations or experiences has an evolutionary history. Organisms that treat threats as more urgent than opportunities have a better chance to survive and reproduce” (Kahneman, 2011, p. 282).

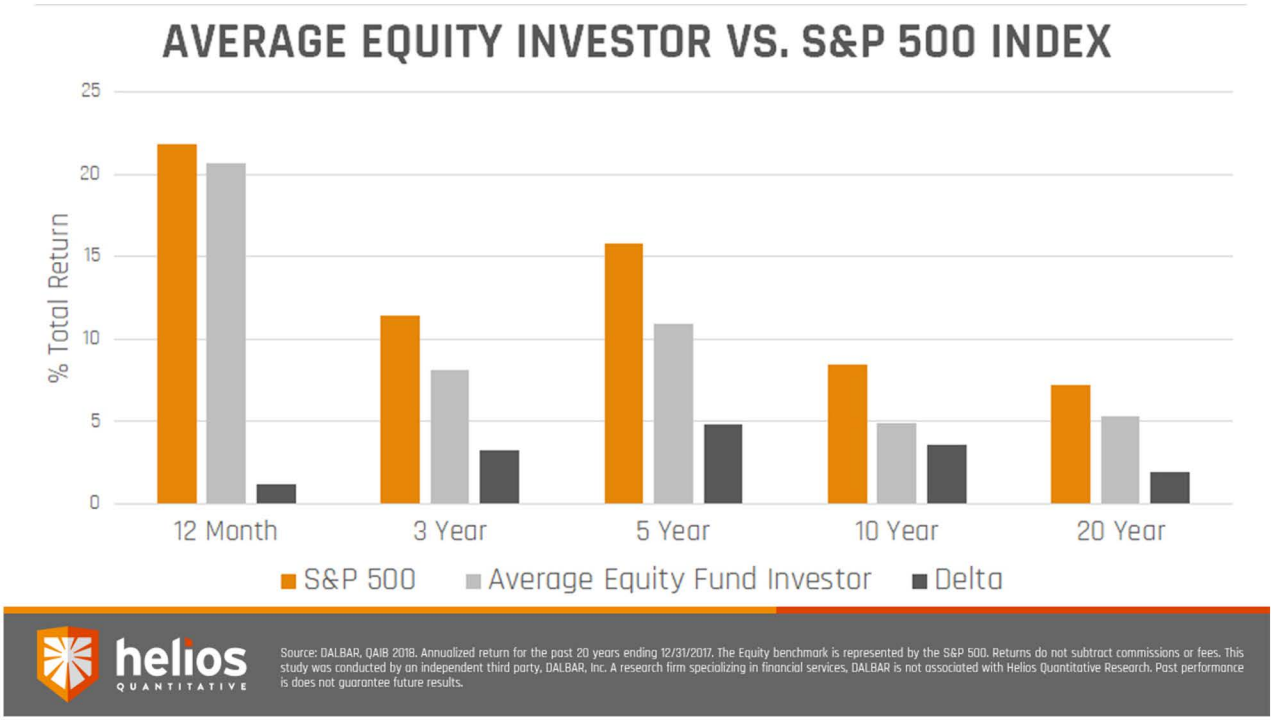
This threat versus opportunity dilemma explains why investors stay in the market too long during bad times and are reluctant to get back in during good times.

How well do investors perform?

For example, Exhibit 1 below compares the everyday investor's performance against their respective benchmark. In the first chart, you will see the S&P 500's total return in orange, the average equity investor's total return in grey, and the difference in total return between the two in dark grey. What immediately jumps out is the nearly two percent difference in annualized total return for the past twenty years. For some quick math, if someone invested $100,000 twenty years ago and underperformed by two percent, they would end up with $124,956 less than what the average annualized index return would have provided. It's also important to note that the study below represents a time window which ended in December of 2017, when the market completed its first "perfect year" of ~22% returns and virtually zero volatility. Although Dalbar has not yet released their findings as of this writing of investor behavior in 2018, they did put out a teaser press release stating the following, "The average investor was a net withdrawer of funds in 2018 but poor timing caused a loss of 9.42% on the year compared to an S&P 500 index that retreated only 4.38%." A simple conclusion would find that investors became overly confident in 2017, then sold at all the wrong times during the turbulent 2018.

Exhibit 1

Illustrative Investor Behavior versus the Benchmark

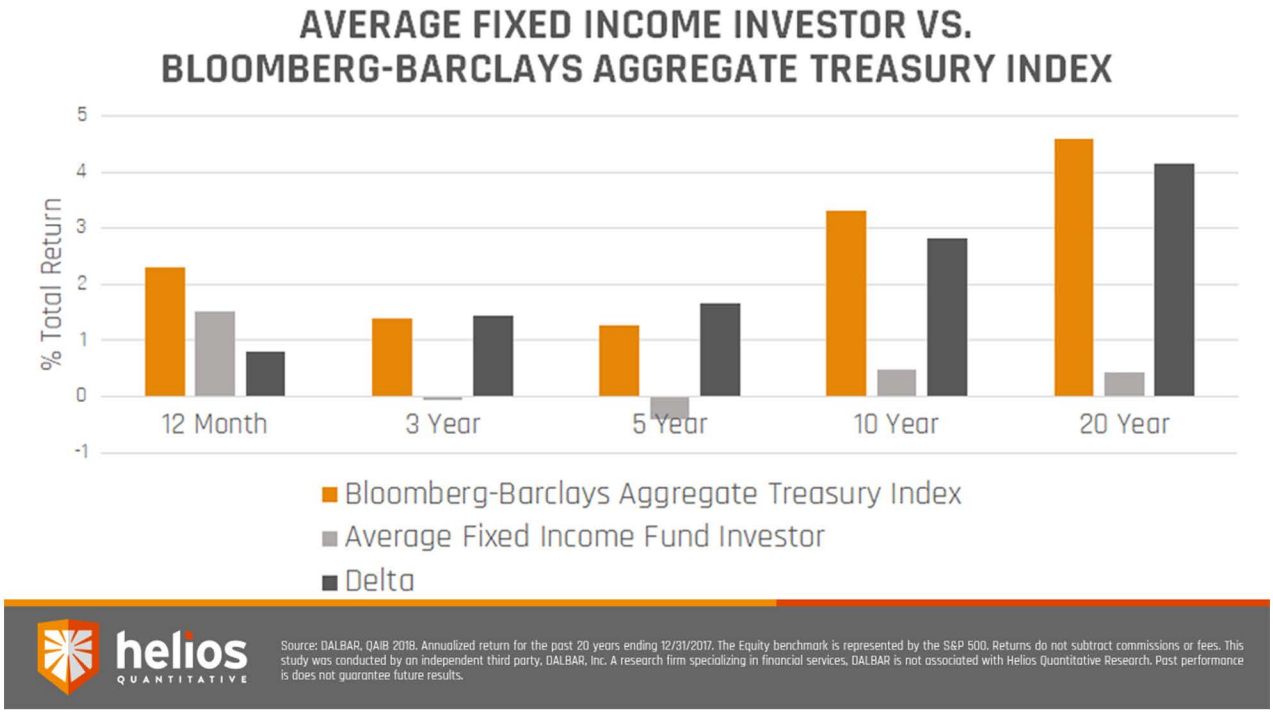


When we look at the Fixed Income space in Exhibit 1A, we see an even greater spread in performance between investors and the most major benchmark. Evaluating the chart below will quickly sober even the most sophisticated discretionary investor high on recent gains, as all signs point to the aggregate winning where it matters most; in the long-run.

Over a twenty-year period, investors have underperformed the Bloomberg-Barclays Aggregate Treasury Index by 4.16% as of December 31st, 2017. Using a similar scenario as the one laid out above, if someone invested $100,000 twenty years ago and underperformed by 4.16% annually, they would have ended up with 56.4% less, which is the difference between having $107,116 or $245,829.

Although many believe the cognitive bias of loss aversion plays a major role when investor's make decisions, Kahneman and Tversky continued their research into other areas of behavioral shortcomings and were able to demonstrate many other hardwired biases' in the human brain. They expounded on economist Richard Thaler's concept of endowment effect bias, which states that people will put a higher value on something they already own than on something they may want to own (Kahneman, 2011). An example of this would be placing a higher value on a stock that you own (and subsequentially keeping it) than on another stock that may be a better value. Loss aversion is a piece of the endowment effect. Hindsight bias is the "I knew it all along" bias which displays the tendency of people to see the outcome of an event and assume they could have easily predicted it . Another is "present bias." When making a decision, people tend to undervalue what may happen in the future in relation to what is happening in the present. Kahneman and Tversky also observed that when people make decisions, they did not seek to maximize utility. They sought to minimize regret (Kahneman, 2011). A singular example of this comes from the creator of Modern Portfolio Theory, Harry Markowitz. He said "I should have computed the historical co-variances of the asset classes and drawn an efficient frontier. Instead, I visualized my grief if the stock market went way up and I wasn't in it – or if it went way down and I was completely in it. My intention was to minimize my future regret, so I split my retirement plan contributions 50/50 between bonds and Equities" (Gray, 2014, p. 1). If Harry Markowitz, the father of asset allocation, cannot overcome emotion when investing his own money, what does that mean for the rest of us? Does that mean we need to give up hope?

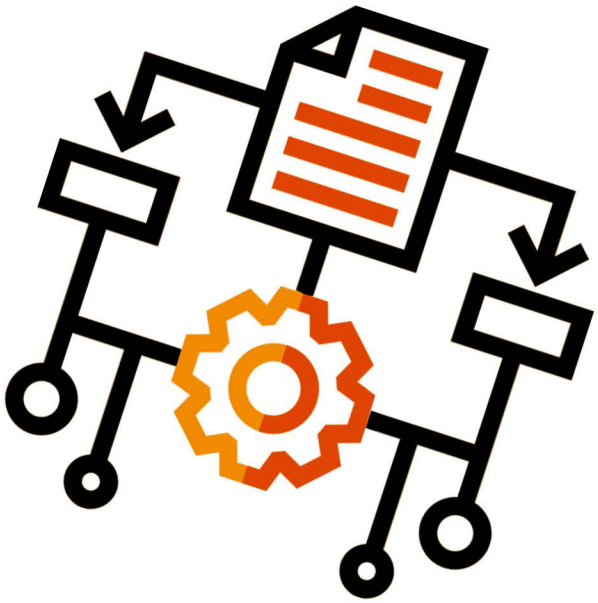
Exhibit 1A
Illustrative Investor Behavior versus the Benchmark



Enter modern algorithms

On the contrary, as the understanding of human emotion has developed, the understanding of how to use math in the form of algorithms has also developed. The hope comes in the process of taking human emotion out of investing by using modern algorithms to solve the investing puzzle. Great accomplishments can be achieved by utilizing the remarkable math method created by Markowitz and adding an unemotional algorithmic approach.

Harry Markowitz's Modern Portfolio Theory (MPT) revolutionized the financial industry. Over the past 70 years, the principles of MPT can be seen in every aspect of financial investing. Before MPT there was only a small sample of information on how to grow your investments while protecting your nest egg. There were Benjamin Graham and David Dodd explaining analytical discipline, John Maynard Keynes describing the difficulties of forecasting the future and John Burr discussing how to value securities based on discounted cash flow. No other post-Great Depression analyses stand out (Peris, 2018). That is until Harry Markowitz published MPT in 1952. MPT gave the investment world what it sorely needed. A set of disciplined rules to follow. Humans seek out systems and processes. They need order. It is hardwired into human DNA because a system provides a better probability of survival.



Humans drive on the same side of the road and stop at red lights. They don't steal; they follow social norms. Rules make them feel safe. Rules give the impression that there is a correct answer, especially stated as a mathematical formula (Peris, 2018). MPT does that for investors. It is a mathematically based set of trusted assumptions and practices that make them feel safe during uncertain conditions. As Frank Ahrens of the Washington Post said, "The allure of a unifying, perfect mathematical formula with which to generate a fortune from financial markets is powerful. It is irresistible to the quant nerds as the formula for turning dross into gold was to the alchemists.... In the frequently irrational financial markets, mathematic models offer the hope of cool reason and certitude, a sort of godlike wisdom" (Gleenson-White, 2011, p. 220).

It also provides a story that can be told to current investors and the generations after. MPT has flaws, however. Critics say the definition of return is not explicit enough, or that MPT does not focus on discounted cash flows to determine value, or that its focus on asset prices and risk has exposed the theory to undesirable outcomes (Peris, 2018). All those critiques may be true, but the real flaw in MPT is the notion that the market is rational. Having described earlier that humans think emotionally first and logically second, it would be impossible for the market to be rational unless emotion was somehow taken out of the decision-making process. Enter modern algorithms.

If you have you ever followed a recipe to bake bread, ever used a pattern to sew a garment, ever used directions to build a piece of furniture from Ikea, then you have used an Algorithm. An algorithm is simply "a set of directions or finite sequences used to solve a problem" (Christian & Griffiths, 2016). Algorithms have been in use for thousands of years. The word "algorithm" was created by the mathematician al-Khwarizmi, who lived between 780 and 850 AD. He authored the mathematical book al-Jabr wa'l-Muqabala. The first word in the title, al-Jabr, contributes the modern word Algebra (Christian & Griffiths, 2016). Predating al-Khwarizmi is a 2000 B.C. Sumerian clay tablet, which describes a system for long division. It is the oldest mathematical algorithm ever discovered (Christian & Griffiths, 2016, p. 3).

The solution

The term "modern algorithm" is usually used to describe a computer-based process that can make millions of calculations in milliseconds. All computers use algorithms to make computations and calculations. It is the combination of computer science, mathematics, engineering, statistics, psychology, economics, cognitive science and additional disciplines used to solve complex problems (Christian & Griffiths, 2016, p. 6). The basic edict of any worthwhile algorithm is to minimize the chore of thought and reduce or eliminate the need to feel (Christian & Griffiths, 2016). Taking emotion out of decision making has been proven time and time again to provide better results. Modern algorithms do not feel anxiety or have biases that will disrupt the decision-making process. In any area where it is difficult to predict the outcome, like baseball games or the stock market, humans are usually inferior to algorithms. An excellent example of this comes from author Michael Lewis and the research he did for his number one bestselling book, about professional baseball, titled Moneyball. Baseball is a game that prides itself on tradition. In baseball, experts called scouts, use their years of experience to determine who their team should pick in the draft or acquire via free agency. The traditional thinking was that computers do not have a place in baseball. A kid can play, or he cannot. That is the way it was for 100 years. That was the case until Major League Baseball became a league of rich teams and poor teams. A poor team had little chance of winning. One of those poor teams was the Oakland Athletics'(A's). The economics of the game forced the team to look outside of tradition for players that were not as expensive but could still play at a championship level. Using algorithms, the A's were able to find players that they could afford but who could also play. The algorithms were able to find talent that the experts were not able to see because of the emotional bias that they had acquired over many years. Due to their human coping adaptions, they could not see what was before them. The anxiety of making a mistake was too great. The value they placed on the players they already had was too high. The algorithms did not have that problem. With the assistance of the unbiased algorithms, the A's became a very good team (Lewis, 2004).

According to the book, Thinking Fast and Slow, author Daniel Kahneman, who won the Nobel Prize for economics in 2002, said that in nearly all fields where predictability is difficult, such as sports, school admissions and market pricing, experts are often inferior to algorithms. Human memory is biased, and people are inconsistent at summarizing complex information. "Whenever we can replace human judgement by a formula, we should at least consider it," he said. Meaning that an algorithm that has more predictability is more rational and does not carry bias. Being emotional thinkers first makes it incredibly difficult to be consistent for anyone, at any stage of the investment process. People don't see what is often right in front of them. Bias and mental short cuts, called heuristics, prevent people from making rational decisions in a field that desperately needs a logical process. Markowitz's Modern Portfolio Theory provides a logical process for building wealth safely over time. What it lacks by way of believing the markets are rational can easily be overcome by using math in the form of modern algorithms to solve the irrational problem. The anxiety people have when they imagine the regret they will feel surrounding certain decisions is incredibly powerful. As Markowitz said, his worry about the regret he would feel was so strong that he went away from his own theory of how to invest successfully to limit his emotional turmoil. If at the time he had a modern algorithm he trusted, he may have invested entirely different and more consistent with his award-winning theory.

As Chris Shuba, Founder and CEO of Helios Quantitative Research, has often said, algorithms are only created to solve problems. The problem is that people are too emotional to invest consistently and successfully.

The solution is to use modern algorithms.

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