

Research on the Development and Application of the Behavioral Finance

Kun Yan^{1,a,*}

¹College of Arts and Sciences/Department of Mathematics, University of Virginia, Charlottesville,
22904, United States

a. ewx6cd@virginia.edu

*corresponding author

Abstract: Investors in the stock market need not be rational in their buying and selling decisions, just as consumers are not required always to act rationally to maximize their utility. When people are no longer rational in their consuming behaviors and lack clear preferences toward risk levels, the expected utility theory becomes less efficient. This paper introduces the elementary method of behavioral finance, especially the prospect theory. The contents rely on the views and theories in Kahneman's paper *Prospect Theory: An Analysis of Decision under Risk* published in 1979. The paper includes both psychological and mathematical explanations of the Prospect theory and other behavioral finance methods. As frequently taught in a normal economic class, the efficient market theory always assumes the rationality of decision-makers, and most of them make their decision in an unbiased, unaffected way. However, investors do not necessarily need to behave rationally for markets to remain efficient. The intersection of human behavior and investment decisions has since evolved as "behavioral finance," which has arisen in the last decades as a consequence of the gaps that have been found in the substantial assumptions of neoclassical finance theories. Research demonstrates that the investment decision-making process is more human than analytical, owing to behavioral biases. Based on the views in Kahneman's 1979 work and recent studies in prospect theory and heuristic decision-making process, this paper explores the elementary method of behavioral finance.

Keywords: Prospect theory, Heuristics, expected utility, decision-making, risk-averse.

1. Introduction

The Efficient Market Hypothesis (EMH) has been the cornerstone of the expected utility theory for nearly thirty years, asserting that financial markets are highly efficient and that asset prices always reflect all available information. Robert J. Shiller (2003), in his seminal overview *From Efficient Market Theory to Behavioral Finance*, characterizes EMH as a "model where speculative prices are assumed to incorporate the best available information at all times" [1]. Despite its widespread acceptance, EMH has faced substantial criticism for its failure to account for the fact that not all investors act rationally, allocate their funds optimally, or process information correctly. This divergence from the assumptions of EMH has spurred the development of behavioral finance, a field that blends insights from psychology and sociology with traditional economic theories.

Behavioral finance seeks to explain market anomalies and investor behaviors that EMH struggles to address. As Andrei Shleifer (2000) notes, many investors “frequently react to irrelevant or misleading information”, leading to suboptimal and irrational decision-making [2]. This field incorporates several key theories, including prospect theory, mental accounting, and heuristics and biases. Prospect theory, first developed by Kahneman and Tversky (1979), provides an alternative to the traditional expected utility approach by accounting for psychological factors such as loss aversion, risk-seeking behavior in the face of losses, and the impact of cognitive dissonance [3]. Additionally, the study of heuristics and biases, also pioneered by Kahneman and Tversky (1974), explores how cognitive shortcuts and systematic biases contribute to irrational financial decisions [4].

This paper primarily focuses on the contributions of Kahneman and Tversky to behavioral finance, examining how their theories can be applied to understand market anomalies and irrational decision-making in real-world scenarios. By bridging the gap between psychological insights and economic models, behavioral finance offers a more nuanced perspective on financial markets, revealing the limitations of traditional economic theories and deepening the public’s understanding of investor behavior.

2. Basis of Behavioral Finance Theory

Before discussing the key concepts in behavioral economics, it is important to introduce some corresponding concepts in the Efficient Market Theory, or conventional economics theory [1]. The central difference between traditional and behavioral finance is whether people will always behave rationally, relocate their funds optimally, or process all the information they have [5]. The first two cases seem straightforward since they imply there exists some utility function and some optimal points on the preference. The third point, although not really intuitive, also demonstrates the central idea of rationality in a natural way. In the classical study of economics, assume two individuals are interested in buying the same company. Both are guaranteed that if they offer sufficient money, the committee will sell this company for cash. Now, suppose that there is no communication between the two buyers. The first buyer knows that he can increase the company’s value by exactly 50 percent and knows the company’s current value. The second buyer, however, knows that he can increase the company’s value by 60 percent but does not know the company’s value. In fact, he knows that the value has to be uniformly distributed over some interval. In this case, the lack of accurate information constrains the second buyer but not the first, who is more likely to acquire the company. Therefore, the digestion of all useful information is a plausible assumption of a rational consumer. The key point here is that the efficient market theory demonstrates this effect of information imbalance by assuming that the company’s value lies within some distribution and uses the expected value to determine the best-off choice of a buyer. So knowing that the company’s value is uniformly distributed over some interval of value actually changes the market situation into a math problem. In reality, whether people will use expected value to make decisions depends on their risk preference and math skills. So, quantifying a price is easy, but it is not easy to use some variables to keep track of consumer’s subjective ideas.

The situation in the real stock market turns out to be more complicated. When using the conventional economics method, it is assumed that the investors know the “intrinsic value” of each security and make decisions with complete rationality [6]. In mathematical terms, it means they have well-defined utility functions, which have absolute maximal points. In addition, for investors who are not rational in their decision-making, their trades will be either canceled out or arbitrated by rational investors. This requirement defines a rational stock market with ideal investors who can estimate the values of their target securities. Rational investors can make quantification easier since the price of the stock will be more predictable with statistical models. However, these constraints are less applicable to real-world markets, where many irrational investors exist. To study the effect of

irrationality, this paper will first introduce Prospect Theory, as initially published by Kahneman and Tversky, and then, after defining the value and weighting functions, the connection between psychological insights and irrational market behavior will be explored [3][4].

3. Theoretical Framework

3.1. Prospect Theory

In 1979, in the paper “Prospect Theory: An Analysis of Decision under Risks”, Kahneman demonstrated his experimental results on different choice problems that can cause a pathological preference relation under the frame of EMH. He criticized the traditional efficient market theory and proposed a new model, which is now known as the Prospect Theory. Kahneman argues that the EMH model is “insufficient in accounting for all the factors that affect consumer behavior, especially psychological factors” [3][7]. To measure the effects of different biases, prospect theory applies a function, named the value function, to predict the preference relation among different choices. Instead of calculating the expected utility value, Kahneman uses a weighted average of each option’s value to determine the total value of a choice.

In the prospect theory, the consumers are usually given a number of options, each with a corresponding outcome and probability. For example, consumer A may have 3 different options after dinner: taking a walk in the neighborhood, washing the dishes, or playing *Crash Royale* on his phone. Now, suppose the probabilities of taking a walk and washing the dishes are both 0.45, while the probability of playing games is 0.1. In this case, the three actions form a bundle consisting of three choices, with probabilities of 0.45, 0.45, and 0.1 and outcomes of 0, 0, and 0 dollars. This collection of choices is later referred to as a bundle of options. Prospect theory, however, can be used to study more tricky and complicated situations where a slight difference between the probabilities of two choices can cause a significant change in consumer preference.

Several psychological factors are useful in explaining the consumer’s behaviors: certainty effect, possibility effect, and isolation effect [3][7]. The certainty effect claims that when the expected values of two options are about the same, the consumer will tend to choose the option with a higher probability even if the outcome of that option is lower. The possibility effect claims that when the probabilities of two options are close to each other and both small enough, consumers tend to favor the option with the larger outcome, even if the expected values are equal.

However, the isolation effect applies to more specific scenarios. In some cases, consumers need to go through multiple stages when making a decision, since they may need to decide whether to attend the first stage, which will eliminate some consumers. Those who enter the second stage are then faced with two options and the corresponding probabilities. Most of the time, consumers are required to choose between the two options in the second stage before they even enter the first stage, so they can immediately take their prize if they pass the first stage. The isolation effect claims that consumers tend to be confounded by the probabilities in the second stage and ignore the potential risks in the first stage, which often leads to irrational behaviors. Notice that to simplify the cases, this study only considers the case where consumers only have two options. In fact, this concept can be generalized to scenarios with n options, and the effects will lead to similar results through induction.

In addition, Kahneman uses a different value function when he calculates the utility of an outcome or wealth. Instead of using the Bernoulli utility function, which is common in the expected utility theory, Kahneman thinks that the value function $v: \mathbf{R} \rightarrow \mathbf{R}$ contains a reference point, and all utility should be measured in terms of losses and gains. Thus, the reference point is located at the origin. In the subset of positive reals representing gains, the value function is convex; in the subset of negative reals representing losses, the function is concave with a greater absolute value of v' [3]. This behavior

shows that individuals are generally more risk-averse when gaining but exhibit greater risk-seeking tendencies when losing.

The weighting function π is defined on the set of all the probabilities in a bundle, i.e., a real-valued function $\pi: [0, 1] \rightarrow [0, 1]$. The weighting function measures people's decision weights on those given probabilities. As mentioned in the example of the possibility effect, when the probabilities are small, people tend to be more interested in the outcomes, not the chances of gaining that outcome. Thus, people's decision weights are slightly greater than the probabilities themselves when the probabilities for each outcome, respectively, are small. Nevertheless, the weighting function almost behaves like the identity function on the closed interval $[0, 1]$ when the sizes of the probabilities are large enough.

3.2. Heuristics

Another perspective on behavioral finance comes from psychology. When people first make a decision in an unfamiliar situation, they tend to be cautious and consider all different possible outcomes comprehensively. However, as the experiences increase, people often refer to their past experiences when they are confronting a similar choice dilemma. Hence, heuristics are those efficient rules followed by people to form judgments as soon as possible and reduce the time spent on decision-making. However, these time-saving strategies are commonly different from the logic or traditional rational choice theory, which can often cause biased judgments. Five factors describe the biases caused by heuristics during decision-making, including anchoring, availability, representativeness, overconfidence, and herding [4].

3.2.1. Anchoring

In many situations, when people predict data or a future event, they start from past data or past events to take reference, and instead of making their judgment right away, most people slowly adjust their prediction from the initial data and then extend it to the future situation. Most people believe this extrapolation method since it is based on historical patterns. However, the initial values may sometimes be insufficient to accurately determine future conditions, resulting in a significant bias known as anchoring or adjustment bias.

3.2.2. Representativeness

Different from anchoring, representative bias is caused when people relate two resembling things together. If action A is related to quality B, people may assume a high probability that A originated from B, based on the stereotype that A represents B [4]. Thus, this approach to judgment often leads to issues.

3.2.3. Availability

In some situations, people evaluate the probability of an event based on the number of similar instances that can be brought to their mind. If certain events happen frequently in one's experience, he will likely assume that the probability of the occurrence of such an event is high. For example, one can be asked to evaluate the possibility of a heart attack among middle-aged people. Then, one's evaluation will depend on whether he can recall such occurrences among his acquaintances. The availability bias can be affected by factors such as the frequency of events, probability, imaginability, etc.

4. Application of Behavioral Finance to Different Markets

In the previous section, some basic principles in Prospect Theory and Heuristics are introduced, while Mental Accounting [8], the last approach to studying irrational behaviors, has not been discussed. It will be briefly explained in the context of its application to real-world markets and decision problems.

4.1. Application in the Stock Market: Disposition Effect

This section about consumers' irrational behaviors in the stock market is based on investigations conducted by Brad M. Barber and Terrance Odean in their paper *The Behaviour of Individual Investors* (2013) [9].

The disposition effect is a concept that describes investors' tendency to prefer selling stocks that have increased in value over those that have decreased in value. This difference between the two types of stocks can explain why many investors experience an overall loss in their profit even if some of their stocks are appreciated.

Based on the work of past researchers, such as the Weber and Camerer experiment (1998), Barber and Odean present the disposition effect on the stock market by developing their own model [9]. The disposition effect is a consistent event, and through their model, Barber and Odean confirm the existence of the disposition effect on the market.

The explanation of disposition effect can be explained using prospect theory. The value function reveals that consumers are risk-averse when they receive a gain and become risk-seeking when confronted with losses. For the stocks with an increased value, they treat them as a gain, so they become risk-averse. This leads to the selling of the good stocks. Conversely, for stocks that have decreased in value, investors view them as losses and adopt a risk-seeking attitude, causing them to hold on to these stocks in anticipation of future value increases. Thus, this irrational behavior will lead to a net decrease in the investors' assets.

4.2. Behavioral Finance Explanation for the “Blind-Box” Market

A blind box is a special type of goods originally from Japan. The boxes usually contain artworks or models of characters, normally made by the assembly lines, that are related to well-known Anime (Japanese Animation), popular movies, or TV shows. Before opening the box, consumers have no knowledge of which character is inside. From the perspective of behavioral finance, the explanation of the popularity of the blind-box market in China is based on the risk-seeking and possibility effects [10]. Most people regard a blind box as a choice bundle, essentially, because each different character model has a different price on the second-hand market. Since there is a possibility of getting a “hidden” character model from each box, the consumers will be more interested in the value of the prospect. This may lead to an increase in their consumption of blind boxes.

5. Conclusion

In conclusion, the evolution from the Efficient Market Hypothesis (EMH) to behavioral finance “reflects a growing recognition that real-world investor behavior often diverges from traditional economic models” [1]. Kahneman and Tversky's work has been crucial in showing that investors are not always rational. Hence, behavioral finance applies theories like prospect theory and heuristics and biases and acknowledges that psychological factors heavily influence market behaviors. By incorporating insights from psychology and explaining real examples, behavioral finance provides a more comprehensive framework for understanding how and why financial markets do not always operate as efficiently as EMH suggests. It also enlightens the author, an economics student, that

bridging these two fields is not only beneficial to deepen the understanding of investor behavior but also offers valuable insights into developing more effective financial models and policies.

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