

## RECENT ADVANCEMENTS IN THE BEHAVIORAL PORTFOLIO THEORY: A REVIEW

Paritosh Chandra Sinha\*  
Anirban Biswas\*\*

### Abstract

*The “modern” portfolio theory of the Nobel laureate Professor Harry Max Markowitz has not been too modern now-a-days. Not simply for that investors are not risk-averse but also for that the “risk-free rate of return” is not risk-free at all. The mean-variance returns are not free from effects of investors’ active investment time-scales. Further, at presence of the noise traders in the financial markets, the efficient frontier becomes inefficient. These flaws in the modern portfolio theory have led the development of the behavioral portfolio theory by Shefrin & Statman (2000). The recent advancements in the behavioral portfolio theory explain effects of investors’ task environments viz., psychological biases, preferences, and sentiment etc. evident at the general environment. The paper critically reviews the different facets of the behavioral portfolio theory: its theoretical, empirical, and experimental evidences, efficient and inefficient market microstructures, systematic and unsystematic risks diversifications, and mental accounting and physical accounting etc.*

**Key Words:** Market Microstructure Theory; Global Financial Crises and Market Meltdowns; Investors’ Psychological Biases and Sentiments; Behavioral Portfolio Decisions; Financial Economics.

**JEL Classification Numbers:** G11; G01; G15; G41

### Introduction

In the literature of Finance, the portfolio selection theory is popularly called as the Modern Portfolio Theory (hereinafter MPT). Professor Harry Markowitz, the Nobel laureate in Economics in 1990, has introduced the Modern Portfolio Theory (Markowitz, 1952a; Markowitz, 1952b) and the theory is developed further in Markowitz (1956; &1959), Merton (1972), Markowitz (1987), and Markowitz (1991). The MPT is based on the basic assumptions that investors in the market choose a set of efficient mean-variance asset

---

\* Principal & Corresponding Author, Assistant Professor in Commerce, Rabindra Mahavidyalaya, P.O.: Champadanga, Dist: Hooghly, W.B., India, PIN – 712401. Mb. (0091) 9732339694;

Email: paritoshchandrasinha@gmail.com, paritoshchandrasinha@yahoo.com

\*\*Ph. D. Research Scholar, Department of Commerce, The University of Burdwan, P.O.: Rajbati, Dist – Burdwan, W.B., India. PIN – 713104. Email: anirbanbiswasindia@gmail.com, anirbanbiswasindia@yahoo.com

combinations, and they are rational, risk averse, and homogeneous. The real investors, on the contrary, have different perceptions about the market and they all are not rational at all (Kahneman, 2003; Felin, et. al., 2017). In the Prospect Theory, Kahneman & Tversky (1979) have found that investors who buy insurance also buy lottery. Even of the dominance of the MPT during the half century of 1952-2000, the Behavioral Portfolio Theory (hereinafter BPT) has addressed a relatively new paradigm of the behavioral theories. The BPT introduces the relevance of behavioral aspects of the human beings those come within the decision-making process for portfolio selections.

Investor's psychological aspects, beliefs and preferences, changed in their portfolio choice decisions at their choice of different time frames (Kahneman & Riepe, 1998). At the presence of the behavioral biases, the MPT has offered limited performance and the same has paved the development of the concept of behavioral portfolio theory (Curtis, 2002). The said development is contemporary to the development of the theory of mental account (Thaler, 1999), over confidence (Barber & Odean, 2001), and have diversification (Barber & Odean, 2000). While Markowitz's Mean-Variance Theory (MVT) is silent about the utility of portfolio consumption goals, these goals are central in the BPT of Shefrin & Statman (2000).

In the BPT, investors do not consider their investments in portfolio rather they consider the same as collection of mental account (MT) sub-portfolios (Thaler, 1985). Every sub-portfolio is associated with their specific goals (Das, et. al., 2010). In the MVT, investor's asset allocation results from a trade-off between their expected returns and risk measured by the variances. For a given level of expected return, investors aim at minimizing the variance of their portfolios. Investors have distinct mental accounts with different levels of aspiration. They do not consider the same as a complete portfolio rather a collection of mental accounting sub-portfolios with distinct aspiration levels (Thaler, 1999). In the BPT, risk relates to the downside risk rather than the MVT's indefinite forms of return variations.

On these contexts, Markowitz's (1952a) MPT appears older than Shefrin & Statman's (2000) BPT and also inconsistent to the present day's high frequency trading data. The behavioral portfolio theory is described in many ways by the researcher, academicians, marketers, and the corporate executives. A behavioral portfolio is informed selection of financial and non-financial assets bundle with reference to investors' behavior bias and preference-based risk weightages. In contrast, in the MPT the weightages are derived with the use of the models on the anticipated utility theory and the limits to arbitrage. The effects of cognitive thinking and psychology in investment decision choices discuss the utility of the systemic noise. Investors' misperception of risks and biases are well documented in Slovic (1972) and Tversky & Kahneman (1974; 1992). In the recent developments, the behavioral portfolio has become the central research hypothesis and the present research is focusing in the literature of the behavioral finance.

In organizing the rest, the study discusses the objectives in Section-II. Section-III discusses the critics of the Standard Portfolio Theory in the financial economics. Section-IV describes the development of the BPT. Section-V lays out the recent advancements in the BPT. Section-VI briefly discusses the findings. Finally, we conclude in Section-VII.

### **Objectives of the study**

In the discourse of reviewing the studies, we have firstly analyzed the literature. It includes the related literature in the Behavioral Finance and the Standard Finance as well. We also examine their pros and cons in the related theories. It is intended that the available literature in the theoretical, empirical, and experimental developments of the BPT and, relating the same with the recent advancements may lead readers in identifying their interconnectedness and there by establishing linkages with the MPT and also to overcome its limitations.

This paper offers how the MPT has become older in its conceptual utility and investors' preferences as well. With the flavors of the behavioral psychology, the BPT may be considered as being the "modified" version of the MPT. Further, this paper tries to put forward a few clues for linking the various advancements in the behavioral portfolio theory.

### **Critics on the Standard Portfolio Theory**

- A) The Modern Portfolio Theory:** The Modern Portfolio Theory (MPT) introduced by Markowitz (1952a) was simple but powerful. There were three elements in portfolio selection: the return, risk, and counter cyclical relation between the stocks. In Markowitz theory preference is given to selection of efficient portfolios those are with the higher returns for similar risk or that have minimum risk with similar expected returns. The limitation of Markowitz (1952a) theory is that the portfolio selection has budget constraints, and it would not lead to true diversification of each individual stock's risks (Bernstein, 2005). Markowitz's (1952a, 1956, & 1959) methodology for choosing the efficient portfolios based on the relationship of risk and return does not hold for the monthly or quarterly returns data of the stock prices. The distributions of the monthly returns and volatilities data are nonetheless normal rather non-normal (Aparicio & Estrada, 2001; Kim & Kon, 1994).
- B) The Markowitz Customary Wealth Theory:** Markowitz (1952b) has explained customary wealth in the line of Friedman & Savage (1948). Markowitz (1952b) has found that the level of customary wealth remains static at the actual level but the same is distorted by the recent windfall gains or losses. Therefore, the utility function is not a static but a dynamic one and one needs constantly update his utility function. Markowitz (1952b) argues for loss aversion rather than volatility aversion as proposed in the MPT. If aspiration level is time dependent choice variable, then portfolio selection becomes dynamic rather than a customary one.

- C) The Efficient Market Hypothesis:** The efficient-market hypothesis (EMH) of Fama (1965a; 1965b, 1970) states that the markets are informationally efficient. The EMH is based on the random walk hypothesis of Godfrey et. al., (1964). If the stocks prices follow the random walk, the EMH states that none can beat the market by using known information consistently. But, the markets are not efficient in the sense that patterns of short-run momentum and long-term reversals exist in the historical prices (Bhandari, 1988; Fama & French, 1992).
- D) Heuristics:** How a portfolio is formed? How many scripts are to be scrutinized in selecting an efficient portfolio? Setting a portfolio choice reference out of the listed scripts is a huge problem. Investors apply availability heuristic in estimating the frequency or probability of the instances or associations (Tversky & Kahneman, 1973). They have found that investors' minds constantly use insufficient information and form belief biases. Investors should use the available knowledge rather than examine the others. Tversky & Kahneman (1974) describe judgment heuristics viz., representativeness, availability, and anchoring and adjustments. Kahneman & Tversky (1992) show that biases of optimistic overconfidence, certainty effect and loss aversion hinder successful resolution of conflicts. Overconfidence leads investors disregarding concessions for adverse situations, certainty effect leads disputants undervaluing some uncertain events, and loss aversion reduces the range of acceptable agreements.
- E) Prospect Theory:** The prospect theory of Kahneman & Tversky (1979) states that several misconceptions influence decision-making process of individuals. Here, the value function is dependent on the gains and losses rather than on the total wealth and the probabilities are replaced with their respective decision weights. It shows that individual behaviors involve different decision choices under the risk and uncertainty. They show that individual's value function is affected by certainty effect and isolation effect. Certainty effect contributes to risk aversion (risk seeking) behavior in choices involving sure gains (sure losses). The modified version of the prospect theory (Tversky & Kahneman, 1992) has four elements: reference dependence, loss aversion, diminishing sensitivity, and probability weighting.
- F) Market Not-efficient:** Individual perceptions (expectations) about present (future) risk also influence portfolio determinations. DeBondt & Thaler (1985) has showed that the financial markets are not efficient. The individuals overreact to unexpected and dramatic news events. They overweight the recent information and underweight the base rate data. The investors also show herd behaviors where they believe on the others behavior and disregard their own information (Banerjee, 1992). Therefore, "The Past losers in the stock market significantly outperform the past winners" (DeBondt & Thaler, 1987).
- G) Mental Accounting:** The MPT does not consider the different individuals' demographic

and psychographic aspects. Thaler (1985, 1999) has showed that consumers' decisions choices follow the mental accounting principles. Das, et. al., (2010) have showed that the individuals construct their portfolios' structure with different mental accounts those are associated with their different target goals, target wealth, and target date of such goals. Individuals may also construct different portfolios with risk seeking (risk averse) attitude at the upside potentials (downside potentials). In doing so, individuals diversify behavioral assets.

- H) SP/A Theory:** In sharp contrast to the assumptions of efficient capital markets with rational investors, human decisions involve emotional aspects like "Hope" and "Fear" (Lopes, 1987). "Emotions determine tolerance for risk, and the tolerance for risk plays a key role in portfolio selection" (Shefrin, 2002; p. 120). For Fear, human needs security and for Hope, it is potential. The SP/A theory provides a general framework for human decision making at the presence of the 'S' for security, 'P' for potential, and 'A' for aspiration. "Security" is closely related to the safety or avoiding low level of wealth. "Potential" is the general desire to achieve higher levels of wealth. "Aspiration" is related to a goal. Further, Lopes & Oden (1999) have showed that aspiration level could be used as the decision reference point as it participates in direct assessment of risky attractiveness. That is, the SP/A theory could predict conflicts in portfolio decision choices (Lopes & Oden, 1999; p. 291).

#### **Developments of the Behavioral Portfolio Theory:**

The BPT in Shefrin & Statman (2000) is linked to Roy (1952) and Telser (1955). Roy (1952) has contributed with the relevance of safety in portfolio selection. Telser (1955) has contributed with different hedging strategies at the expected return in the positive and negative zones. Lopes (1987) has observed that the investors' aspirations for reaching at specific level of wealth incorporate their mental status and thereby, Kahneman & Tversky's (1979) have linked the same in their prospect theory. Further, Tversky & Kahneman (1981) have addressed the effect as Framing. They have showed that the investors frame the portfolio related problems in different ways. The investors' psychological principles govern their perceptions of the decision problems differently and thereby, they evaluate their probabilities and outcomes differently.

Shefrin & Statman (2000) have introduced the BPT in the single mental account version as well the multiple mental account version. They have explored behavioral implications for the portfolio construction and security design. The portfolios of the behavioral investors follow Friedman & Savage's (1948) utility criterion and they choose both bonds and lottery tickets. The BPT efficient frontier differs from that of the MPT efficient frontier. The BPT portfolios also differ from the CAPM portfolios with the two-fund separation principle for the risk-free investment fund and systematic risk fund as well. The BPT mental accounts suggests for the aspiration layers associated with the pyramids of low aspirations (viz., avoiding poverty) and

high aspirations (viz., a shot at riches). These pyramids link the BPT portfolios with the mean-variance, the CAPM, and the VaR portfolios (Shefrin & Statman, 2000; p. 150). They suggest that the risk-free or investment grade bonds (speculative junk bonds) could proxy for the bonds for the low aspiration mental account (high aspiration mental account).

The BPT is developed on the choice theories under uncertainty: the SP/A theory (Lopes, 1987; Lopes & Oden, 1999) and the prospect theory (Kahneman & Tversky, 1979). The theory resolves two behavioral anomalies: buying lottery tickets and risky bonds by the same investors, and not buying insurance policies by those who buy lottery tickets very often. In choosing BPT portfolios, the BPT investors consider the "...expected wealth, desire for security and potential, aspiration levels, and probabilities of achieving aspiration levels" (Shefrin & Statman, 2000, p. 128) while the MPT investors who consider only the mean-return and variance-risk components of expected returns. Shefrin & Statman (2000) is directed towards developing optimal portfolios and the securities those are optimally aligned with preferences of the specific investors. Such construction could be cost-free since in the real-world, construction costs influence the portfolio design and limit the portfolio size (Allen & Gale, 1988). Shefrin & Statman (2000) proposed that the multi period BPT effects can be used in explaining the demand side of capital structure choice and dividend policy, that is, how shareholders, investors, and traders perceive to trade and react in the markets on such decisions.

In the next section, the study describes the recent developments in the behavioral portfolio theory (BPT). To put forward a critical review of the studies, the time reference "recent" is treated the year of 2000 onwards. The study reviews different contexts in the advancements of the BPT. The recent advancements in the BPT are extended in many wings. It firstly explores the theoretical advancements, then the empirical advancements, and finally, the experimental advancements. The paper depicts these advancements in the BPT as under.

#### **V. Recent Advancements in the Behavioral Portfolio Theory:**

The recent advancements in the BPT could be broadly classified into three categories: (i) theoretical advancements, (ii) empirical advancements, and (iii) experimental advancements. The study reviews these divisions of the relevant researches in the following three sub-headings.

**(i) Theoretical advancements:** The theoretical advancements in the BPT are mostly related to the psychological factors of the individuals. It includes individual choices, preferences, beliefs, and biases etc.

Fisher & Statman (2002, 2003) have showed that consumers' confidence grows along with investors' bullishness and there is statistically significant positive relationship between changes in consumer confidence and changes in individual investors' sentiments. The role of the investors' demand is also visible in their BPT choices. Statman (2000) finds that the index of the socially responsible stocks performs better than the S & P 500 Index and the index of the socially

responsible mutual funds do better than conventional mutual funds over the 1990–98.

The people sometimes separate decisions which in principle should otherwise be combined (Ritter, 2003). Individuals assign different functions to each of their different asset groups. These may have an irrational and negative effect on their consumption decisions and other behaviors. Das, et. al., (2010) have showed that the features of MPT and BPT could be integrated into the mental accounting (MA) framework where it includes an MA structure of portfolios, a definition of risk as the probability of failing to reach the threshold levels in each of their mental accounts, and attitudes toward risk that vary by account.

In BPT portfolio formation, investors are also inclined toward various psychological biases. These biases lead them to cognitive errors. At difficult and uncertain decisions situations, people make heuristic simplification and they commit behavioral biases (Chen, et. al., 2007). These biases also include heuristics rules of thumb, beliefs, judgments, preferences, and emotional lines as well. Statman, et. al., (2006) have found that at self-attribution bias, investors' overconfidence and trading volume varies with the past returns. Statman, et al., (2008) have showed that the behavioral “affect” plays an overt role in the pricing of stocks while their high subjective risks come with the negative effects.

**(ii) Empirical advancements:** The empirical advancements in the BPT are mostly related to the exploration of aspiration of individuals, diversification strategy, utility of risk aversion, and the use of CAPM model etc.

Statman (2004) has observed that the levels of diversification in the U.S. investors' equity portfolios present a puzzle. The average investors hold only 3 to 4 stocks while the optimal MPT portfolio size exceeds 300 stocks. The puzzle can be resolved with the behavioral assumption that investors view their portfolios as layered pyramids, where the bottom (top) layers are designed for the downside protection (upside potential) with risk aversion (risk seeking) behavior as to avoid poverty (aspire riches). Thus, at buying lottery or holding undiversified portfolios, both strategies are consistent with the behavioral portfolio theory.

With the U.S. stock prices during 1995–2011, Pfiffelmann, et. al., (2016) has showed that the BPT could be reconciled with the MPT but the same cannot be used interchangeably. Shefrin & Statman's (2000) optimal portfolio is Mean Variance efficient in more than 70% of cases. The BPT portfolio results in a higher risks, high returns, and positively skewed returns while the risk aversion coefficient of the BPT portfolio is up to 10 times lower than the risk aversion degree in the MPT investors. Chen (2016) has showed that the BPT in the SP/A analysis is closely related to the VaR analysis and optimization involves trade offs between expected wealth and probabilities of falling short of an aspiration level. The usual aspiration level in VaR analysis is a poverty level while the BPT based on SP/A theory corresponds to the high aspiration framework: “aspiration level pertains to riches” rather than to poverty.

With the Indian BSE data in the CAPM framework, Chudhary & Chudhary (2010) have examined the relationship between stock returns and systematic risk. The study explores if the CAPM adequately captures all-important determinants of the returns including the residual variance of stocks. The study finds that the residual risk has no effect on the expected returns of the MPT portfolios.

**(iii) Experimental advancements:** The experimental studies in the BPT are mostly related to the exploration of risk aversion attitude and aspiration of individuals, diversification strategy, the utility of risk aversion, and the use of models etc.

By using questionnaire responses Barsky, et. al. (1997) have explored the effects of relative risk aversion on portfolio construction. Kroll, et. al. (1988) have showed that there is strong experimental and practical evidence showing that investors ignore covariances when constructing their portfolios. In an experimental study of two risky assets with perfectly negatively correlated payoffs, Ackert, et. al., (2015) isolate factors those compel individuals to hold optimal portfolios. They have showed that investors do not hold optimal portfolios. The optimal portfolio choice becomes a special case if the variance cost of holding an imbalanced portfolio is substantial and the feedback on period-by-period outcomes is suppressed.

In an experimental study, Ehm, et. al. (2014) have examined whether private investors relate risk attitude with their investments in risky assets. They have found that investors' risk attitude, risk perceptions, and the investment horizon are strong predictors for risk taking. Investors choose mostly similar risk asset independent of their volatility. People apply two mental accounts for risk-free investment and risky investment while risk attitude influences the weightage to the risky asset.

Das & Statman (2013) have showed that the 'put options' are useful in 'downside protection' mental accounts whose goal is avoiding poverty, whereas call options are useful in 'upside potential' mental accounts whose goal is a shot at riches. Larrick, et al. (2009) have found that individual aspirations to meet targeted goals increase their intention of risk-taking. For example, an investor if he can reach his return goal with treasury bond investment strategy will prefer it over a risky strategy even if the latter strategy could yield more. He will choose the risky strategy if the riskless strategy could not meet his goal. In Table-1, the study puts forward a mapping of the important researches, their propositions, methodology and variables so used, and the findings and observations, and thereby, correlates the same with the present study.

### **Findings:**

The mapping forwards the readers identifying the interconnectedness between the MPT and the BPT. The present section now establishes linkages of the two theories, and thereby, puts forward framework how researchers have overcome the limitations of the MPT. Investors'

**Table-1:** Mapping of Researches, Variables, and Findings on the Advancement of the Behavioral Portfolio Theory

Behavioral Considerations	Research Papers	Research Proposition	Methodology and Variables	Observations and Findings
Mental accounting	Thaler (1999)	Individuals and households use mental accounting and cognitive operations to organize, evaluate, and keep track of financial activities.	<p>Three components:</p> <ul style="list-style-type: none"> <li>i. Input of ex-ante and ex-post cost-benefit analyses: How outcomes are perceived and experienced. How decisions are made and evaluated.</li> <li>ii. Assignment of activities to specific accounts: Label sources and uses of funds in real and mental accounting systems. Grouping of expenditures into categories and identify implicit or explicit budget constraints.</li> <li>iii. Frequency evaluation and 'choice bracketing': Balancing of accounts daily, weekly, and yearly etc.</li> </ul> <p>Comparing strategies for meeting current lifestyle expenses with those for fixed investment horizon. Risk measures are based on events and do not require specification of a time interval. Separate risk tolerance estimates for separate goals rather than an overall risk tolerance for each investor.</p>	These mental accounting components violate the economic principle of fungibility. Mental accounting influences choice.
	Nevins (2004)	Portfolio construction and risk management are closely aligned with client goals. Investment solutions consist of multiple strategies linked to multiple goal statistics.		Better result could be achieved by linking individual strategies to specific goals. The behavioral biases are more easily managed with this goal-based portfolio approach.
	Das, et.al. (2010)	Investors have many attitudes toward risk those vary by goals and they perceive risk as the probability of not reaching the threshold levels of these goals.	Integration of investors' portfolio production and consumption by combining the features of Mean Variance Efficient Portfolio Theory (MVT) and Mental Accounting (MA) into a unified framework. The MVT, MA, and risk management using VaR are connected, providing an analytic mapping between the different problem formulations. The VaR-analogous representation provides an analytical approach to check for feasibility of MA portfolios.	Over twomoment portfolio optimization leads to wealth maximization. It is subject to threshold level of return at given probability level and is equivalent to MPT optimization.

Behavioral Considerations	Research Papers	Research Proposition	Methodology and Variables	Observations and Findings
Psychological biases	Chen, et. al. (2007)	Investors are inclined toward psychological biases and they make cognitive errors. At uncertainty people make predictable but non-optimal choices due to heuristic simplification.	Investor characteristics: (a) experienced investors, (b) middle-aged investors, (c) active investors, (d) wealthier investors, and (e) investors from large cosmopolitan cities to see whether they are less inclined toward making cognitive errors in their investing decisions.  Methodology: three-step approach. First, assessing trading performance and determining the existence of behavioral biases. Second, comparing findings for individual investors with institutional investors. Third, cross-sectional regression tests on how individual investors behave with different characteristics	Investors show three behavioral biases: disposition effect; and overconfidence and representativeness bias. Investors also show cultural differences.
	Sinha (2018)	At the trading biases, the investors' dynamic decision thresholds reflect aggregate noisy signals of emotions, memories, and logics.	Noise, in decision making, incorporates cognitive behavioral biases towards <i>ambiguity aversion, illusion of control, over confidence, elicited beliefs, and myopic loss aversions</i> . Subject-traders, classified into the noise traders and informed traders, in experiments differ from theoretical reference points and exploring if their price quotes replicate the actual market prices, at least partially.	Noise traders show greater proximity to their theoretical reference points than those of the informed traders. Informed traders show conservatism at <i>overconfidence</i> and <i>elicited beliefs</i> . Subject-traders show limited replication of market prices.
	Sahi, et. al. (2013)	Individual investor's decision making behaviors are insightful in their actual decision making on their beliefs and preferences.	The method of exploratory semi-structured interviews is used to identify and describe underlying thoughts and feelings: Tendency to rely on a point of reference, information availability, outcome bias, hindsight bias, funding and budgeting bias, and herding bias. These thoughts and feelings affect the individual investment decision-making behavior. Decision-making rationales are analyzed by means of open coding of verbal data.	Individual investors have numerous beliefs and preferences and these induce bias in the financial investment decisions. They reveal the design of investor's mind and not the flaws in investor's mind.

Behavioral Considerations	Research Papers	Research Proposition	Methodology and Variables	Observations and Findings
Systematic noise risk	Barber, et. al. (2009)	At psychological biases, individuals trading is highly correlated and persistent. That is, if the purchase versus sell are correlated across individual investors.	Trades data includes data of large national discount broker and large retail broker. Analyses focus on buying intensity. Purchase and sell data are correlated across individual investors out of samples randomly chosen. Methodology for correlation analysis: (i) Contemporaneous correlation: correlated buy/sell decisions are straightforward, (ii) Time-series correlation: to test whether buying intensity persists over time over proportion buys in each stock's buying intensity over the consecutive months.	Systematic trading is not primarily driven by institutional herding or systematic risk-aversion. Psychological biases lead disposition effect to buy stocks with strong recent performance, hold loss stocks, and become net buyer with high volume.
	Sinha (2015)	Noise has systematic and firm-specific components those vary over time.	The paper explores noise traders' risk. It utilizes intra-day 1D and 5D trade-prices, trade-volumes, and trade-times of the NSE and BSE. The systematic and firm-specific components of noise have information and noise aspects. At lag-periods, traders long-short positions over these markets can hedge fundamental systematic and fundamental firm-specific shocks and may detach noise shocks. Once stocks are traded at long-short horizons, traders long-short returns expose the noise aspects across stocks.	Prices at 1D and 5D data impound noise while weekly data show its moderate exposures. Time-varying idiosyncratic noise is highly persistent at presence of noise traders. Prices impound information and noise during the trading days.
	Hu & Wang (2013)	Stock returns are influenced by the systematic correlated trading of noise traders.	Retail traders are considered as the main noise traders in the capital market. Using the Chinese retail trade data from 2005 to 2009, the study explores their trading preferences and the correlation of retail tradings. The study uses a multifactor model to test if the co? movement of stock returns be explained by individual sentiment.	Small? cap stocks are preferred by noise traders. Their net stock demand is systematically correlated. Sentiment plays key role in the formation of stock returns and trading behaviors of retail investors are irrational.

Behavioral Considerations	Research Papers	Research Proposition	Methodology and Variables	Observations and Findings
<p>Unsystematic noise risks</p>	<p>Li, et. al. (2008)</p>	<p>The unsystematic noise risks of the winners and the losers change in a predictable but different and vary over time. The momentum returns compensate the time-varying unsystematic risk.</p>	<p>The study investigates whether the momentum profits in the monthly UK stock prices adjusted for dividends data are a compensation for time-varying risk within GJR-GARCH(1,1)-M versions of the market and Fama and French models. It also tests whether the momentum profits can be explained by a simplified version of the above models in the standard GARCH(1,1)-M framework.</p>	<p>The winners' (Losers') volatility is more sensitive to recent (distant) news than that of the losers (winners). The losers are more likely than the winners to withhold the bad news and they are also more likely to withhold information.</p>
	<p>Goyal &amp; Santa C lara (2003)</p>	<p>This paper takes a new look at the predictability of stock market returns with risk measures.</p>	<p>The study computes the monthly variance of a portfolio using within-month daily return data. It uses cross-sectional variance of stock returns along with the time series of average stock volatility. On predictive regressions, the study explores the linkage between average stock risk and the market return. It also regresses realized excess returns on the lagged volatility measures. It tests if the average stock variance is a predictor of subsequent market variance. It also regresses market variance on the lagged value and lagged average stock variance.</p>	<p>Consistent with models of time-varying risk premia based on background risk and investor heterogeneity, there is significant positive relation between average stock idiosyncratic risk and the market returns. The market risk has no forecasting power for the market return.</p>
	<p>Fu (2009)</p>	<p>The under diversified investors are compensated for bearing idiosyncratic risk</p>	<p>The study uses the exponential GARCH models to estimate expected idiosyncratic volatilities. The exploratory variables are the expected idiosyncratic volatility and other control variables are put on the right-hand side to regress the return variable firstly. Idiosyncratic risk is defined alternatively as the volatility of (i) the excess return on a broad market portfolio or the difference between the return on a portfolio of small stocks, or (ii) the return on a portfolio of large stocks, or (iii) the difference between the return on a portfolio of high book to market stocks and the return on a portfolio of low book-to-market stocks.</p>	<p>Idiosyncratic volatilities are time-varying. The study finds significantly positive relation between the estimated conditional idiosyncratic volatilities and expected returns.</p>

Behavioral Considerations	Research Papers	Research Proposition	Methodology and Variables	Observations and Findings
Efficient market microstructure	Lo (2005); Tuyon& Ahmad (2016).	The traditional models of modern financial economics can coexist alongside the behavioral models.	The degree of market efficiency is related to market ecology: competitors, profit opportunities, and the adaptability of market participants. The behavioralists describe irrationality and market inefficiency, loss aversion, overconfidence, overreaction, mental accounting, and behavioral biases. The both are consistent with an evolutionary model of individuals adapting to a changing environment via simple heuristics.	The new paradigm is qualitative in nature. It shows that the Adaptive Markets Hypothesis (AMH) could provide many uses of concrete applications for both the investment managers and the consultants.
	Mouna&Anis (2015)	The effect of financial literacy, the cognitive biases, and errors constitute the key factors of the individual investor's failure.	The study applies cognitive structural analysis as a tool for structuring ideas and collective reflections. This approach leads to understanding of the cognitive design of individuals. The approach is to identify the major factors of the individual investor's failure. It experiments with 128 individual investors actively trading in the Tunisian stock market. It allows collective cognitive mapping of the individuals at the presence of factors affecting the success in the market.	The lower level of financial literacy in financial education and concepts, and higher level of cognitive biases of individual investors in familiarity and anchoring are the main obstacles limiting the success of the investors in the stock market.
	Davies & Servigny (2012)	Unified investment management is possible towards portfolio optimization at behavioral components and use of advances in utility theory.	Developing an explicit framework addressing behavior through a more complex utility function towards modern portfolio theory. It adjusts to some key behavioral problems with respect to the traditional risk-return trade-off. It incorporates the descriptive theory of choice embodied in cumulative prospect theory by using an exponential utility function with different levels of risk tolerance. Non-normal distribution effects of returns capture shorter-run asset behavior. Loss aversion and reference dependency is accounted for through shape adjustments of the utility function.	It embeds investor behavior via explicit utility functions. It links the effect of estimation uncertainty with differences in the utility function to provide an inclusive framework with behavioral investment management.

Behavioral Considerations	Research Papers	Research Proposition	Methodology and Variables	Observations and Findings
Inefficient market microstructures	Milan & Eid Jr. (2017)	Personal characteristics drive the level of diversification and reallocate resources in risky assets.	It uses heterogeneous database of individual financial allocations from Brazil. The characteristics of Brazilian investors viz., education, sex status, married or unmarried etc. have been explored and their effect on investment decisions are examined. The examination is if psychological biases determine investment decisions.	High educated and married investors tend to display diversified portfolios. Male investors have 43% greater likelihood of investing in risky assets than females. Married investors tend to exhibit conservative portfolios. Traditional investors are underdiversified and they allocate in in traditional and safety assets.
	Sinha (2016)	Investors in the stock markets act or react on both own information and noise as well. They may believe on their own information or otherwise simply herd.	The study explores herd behavior from the behavioural finance perspectives. It develops a theory of herding behaviour and extends the models of Banerjee (1992) and Bikhchandani, et., al., (1992). It empirically tests the herd behavior with the high frequency intraday trading data for the real trade-time or timestamp, trade-volume, and trade-price for scrips listed for their trading in both the BSE and the NSE.	The study shows that investors in the BSE Sensex and NSE Nifty stock markets show crowd of positive and negative herding. There is huge noise along with information in the market equilibrium.
	Nassirtoussiet. al., (2014)	Sentiment in the online buzz in the social media and the online news determine the predictability of financial markets and cause huge gains or losses.	It involves interdisciplinary nature at the core of both behavioral-economic topics and artificial intelligence. It reviews market prediction on online-text-mining. It produces the generic components that they all have. It compares each system with the rest and identify their main differentiating factors.	The comparative analysis of the systems expands onto the theoretical and technical foundations.

investment decision framework for portfolio selection are the outputs of an open system decision process at the interaction of both known and unknown factors and the same is not a closed system at the independent dispense of the structure of the MPT. In the BPT, the portfolio selection choices are of open-system decisions such that the general environment i.e., the external environment and the task environment i.e., investors' internal environment both makes contributions in the dynamic decision choices. The general environment includes market structure, government regulations, transaction infrastructure, global information flows, and noise induced transaction frameworks etc. The task environment includes investors' investment goals, strategies, self-regulation for the beliefs and biases, preferences and reference points, and mental accounting, etc. The both environments are interconnected and dynamic over the time. The brief findings about the interconnectedness, linkages and over arching observations are as follows.

(i) In the context of mental accounting, Thaler (1999) views the open system decision process with cognitive operations to organize, evaluate, and keep track of investors financial activities. These operations are performed at the influential presence of the elements of task environment and therefore, it violates the principle of fungibility. Nevins (2004)'s framework aligns multiple strategies with multiple goals and puts over emphasis on the task environments. At exposures of the general environment, Das, et.al. (2010) have multiple attitudes toward risk that vary by different goals at perceived risks of not accomplishing threshold levels of the goals. The research advancement in the BPT portfolio theory integrates the features of MPT and Mental Accounting (MA) into a unified framework.

(ii) At investors' psychological biases and elements of uncertain general environment, Chen, et. al., (2007) identify cognitive errors and resulting suboptimal choices in heuristic simplification. Sahi, et. al. (2013) show insightful decision-making behaviors are dependent on elements of task environment such as investors' beliefs and preferences and reveal roles of the reference point, information availability, outcome bias, hindsight bias, funding and budgeting bias, and herding bias. Sinha (2018) shows that investors' dynamic decision thresholds reflect aggregate noisy signals of emotions, memories, and logics. The advancement shows that the noisy signals lead towards greater proximity to theoretical reference points while information boldens conservatism at *over-confidence* and *elicited beliefs*.

(iii) Further advancements in Barber, et. al. (2009) show that investors psychological biases, which are task environment components, develop systematic noise risks- a general environment element and transforms them into disposition effect in buying stocks at high prices, holding loss stocks, and resulting bubbles into the market with high volumes of the net buyers. At presence systematic correlated trading as aggravated by noise traders' preferences, Hu & Wang (2013) also offer transformation of task environment into general environment. In establishing linkages, Sinha (2015) has showed that noise has time varying systematic and

idiosyncratic components while the time-varying idiosyncratic noise is highly persistent at presence of noise traders and prices impound both information and noise. Therefore, the elements of the task environment and the general environment are interlinked in the dynamic pricing framework and the same evolve over time at presence of information and noise at dispense of the traders.

(iv) The said interrelation is empirically found in Goyal & Santa-Clara (2003). The advancement here is that there is time-varying risk premia at presence of investor heterogeneity, idiosyncratic risk, and the market returns. Further advancements in Li, et. al. (2008) show that unsystematic noise risks of the winners and losers are predictable, different, and time-varying and momentum returns compensate the time-varying unsystematic risk. Also, in Fu (2009), under diversified investors are compensated for bearing idiosyncratic risk.

(v) The research advancements towards interconnectedness and linkages between the MPT and the BPT, therefore, puts forward the coexistence of the theoretical propositions of the standard finance and the behavioral finance theories. The unified investment management proposition in Davies & Servigny (2012) incorporates the cumulative prospect theory with different levels of risk tolerance and forwards advances in the utility theory. Lo (2005) and Tuyon & Ahmad (2016) show that the conditions of market efficiency is related to the foundations of the market ecology. The evolutionary process of investors adapting to the changing environment via simple heuristics show that both the MPT and the BPT coexists. The advancements in Mouna & Anis (2015) and Milan & Eid Jr. (2017) show investors' adaptiveness via personal characteristics viz., financial literacy, cognitive or psychological biases, and errors etc.

(vi) The evolutionary process could develop further with the inputs in the meta-environment. For example, Nassirtoussiet. al., (2014) shows that investors' sentiments could evolve as online buzz in the social media and the online news, thereby, could determine the predictability of financial markets and the performances of the stocks as well. Again, at the presence of news or signals in the meta environment, the advancements in Sinha (2016) can be extended in exploring persistent coexistence of noise and information at the positive and negative herding in the prices.

### **Conclusion:**

In the backdrop of the 2008-09 financial recession, the relevance of the MPT in Markowitz (1952a, 1956, 1959), both from the theoretical and empirical contexts, has mostly been observed as missing now-a-days. The argument is viewed not simply that the real-world investors are human beings with aggregate noisy signals at their emotions, memories, and logics, and not only that they are not risk-averse but also for that the "risk-free rate of return" is not risk-free at all. The mean-variance returns are not free from effects of investors' active investment time-scales. At the presence of the noise traders in the financial markets, the efficient

frontier hypothesis becomes inefficient. Investors' well diversified but profitable portfolio selection is nonetheless a structured decision framework but an unstructured one. These flaws in the MPT have led development of the BPT by Shefrin & Statman (2000).

The BPT is further developed in many facets. The paper critically reviews these facets: its theoretical, empirical, and experimental studies. The recent advancements in the BPT have showed that effects of behavioral aspects could be incorporated as task environment elements and could be considered in an adaptive decision framework along with the factors of the general environment, the study limits its scope within reviewing recent development of the BPT. Further researches may be forwarded in constructing a practicable adaptive behavioral portfolio model. In the backdrop of the financial recession, the adaptive behavioral portfolio model is an urgent research gap that has been remained unaddressed till date.

**Reference:**

1. Ackert, L. F., Church, B. K., & Qi, L. (2015). An experimental examination of portfolio choice. *Review of Finance*, 20(4), 1427-1447.
2. Allen, E., & Gale, D. (1988). Optimal Security Design. *Review of Financial Studies*, 1(3), 229-263.
3. Aparicio, F., & Estrada, J. (2001). Empirical distributions of stock returns: European securities markets, 1990–1995. *European Journal of Finance*, 7(1), 1–21
4. Banerjee, A.V. (1992). A Simple Model of Herd Behavior. *The Quarterly Journal of Economics*, 107(3), 797-817.
5. Barber, B. M., Odean, T., & Zhu, N. (2009). Systematic noise. *Journal of Financial Markets*, 12(4), 547-569.
6. Barber, B., & Odean, T. (2000). Trading is hazardous to your wealth: The common stock investment performance on individual investor. *The Journal of Finance*, 55(2), 773– 806.
7. Barber, B., & Odean, T. (2001). Boys will be boys: Gender, overconfidence, and common stock investment. *Quarterly Journal of Economics*, 116(1), 261–292.
8. Barsky, R. B., Juster, F. T., Kimball, M. S., & Shapiro, M. D. (1997). Preference Parameters and Behavioral Heterogeneity: An Experimental Approach in the Health and Retirement Study, *Quarterly Journal of Economics*, 112(2), 537-579.
9. Bernstein, P. L. (2005). *Capital Ideas: The Improbable Origins of Modern Wall Street*. Hoboken, New Jersey: John Wiley & Sons, Inc.
10. Bhandari, L. C. (1988). Debt/equity ratio and expected common stock returns: Empirical evidence. *The journal of finance*, 43(2), 507-528.

11. Bikhchandani, S., Hirshleifer, D., & Welch, I. (1992). A theory of fads, fashion, custom, and cultural change as informational cascades. *Journal of political Economy*, 100(5), 992-1026.
12. Chen, G., Kim, K. A., Nofsinger, J. R., & Rui, O. M. (2007). Trading performance, disposition effect, overconfidence, representativeness bias, and experience of emerging market investors. *Journal of Behavioral Decision Making*, 20(4), 425-451.
13. Chen, J. M. (2016). Beyond Hope and Fear: Behavioral Portfolio Theory. In *Finance and the Behavioral Prospect* (pp. 247-281). Palgrave Macmillan, Cham.
14. Chudhary, K., & Chudhary, S. (2010). Investigating the relationship between stock returns and systematic risk based on CAPM in the Bombay stock exchange. *Eurasian Journal of Business and Economics*, 3(6), 127–138.
15. Curtis, G. (2002). Modern Portfolio Theory and Quantum Mechanics, *The Journal of Wealth Management*, 5(3), 713; DOI: <https://doi.org/10.3905/jwm.2002.320449>
16. Das, S. R., & Statman, M. (2013). Options and structured products in behavioral portfolios. *Journal of Economic Dynamics and Control*, 37(1), 137-153.
17. Das, S., Markowitz, H., Scheid, J., & Statman, M. (2010). Portfolio optimization with mental accounts. *Journal of Financial and Quantitative Analysis*, 45(2), 311-334.
18. Davies, G.B., & Servigny, A. (2012). *Behavioral Investment Management: An Efficient Alternative to Modern Portfolio Theory*. US: McGraw-Hill.
19. DeBondt, W. F. M., & Thaler, R.H. (1987). Further Evidence on Investor Overreaction and Stock Market Seasonality. *The Journal of Finance*, 42(3), 557-581.
20. DeBondt, W.F.M., & Thaler, R.H. (1985). Does the stock market overreact? *Journal of Finance*, 40(3), 793-805.
21. Ehm, C., Kaufmann, C., & Weber, M. (2014). Volatility inadaptability: Investors care about risk, but cannot cope with volatility. *Review of Finance*, 18(4), 1387-1423.
22. Fama, E. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *Journal of Finance*, 25(2), 383–417.
23. Fama, E. F. (1965a). Random Walks in Stock Market Prices. *Financial Analysts Journal*, 21(5), 55–59.
24. Fama, E. F. (1965b). The Behavior of Stock-Market Prices. *Journal of Business*, 38(1), 34–105.
25. Fama, E.F., & French, K. (1992). The cross-section of expected stock returns. *Journal of Finance*, 47(2), 427-465.

26. Felin, T., Koenderink, J. & Krueger, J.I. (2017). Rationality, perception, and the all-seeing eye, *Psychon Bull Rev*, 24: 1040. <https://doi.org/10.3758/s13423-016-1198-z>
27. Fisher, K. L., & Statman, M. (2002). Blowing bubbles. *The Journal of Psychology and Financial Markets*, 3(1), 53-65.
28. Fisher, K. L., & Statman, M. (2003). Consumer confidence and stock returns. *Journal of Portfolio Management*, 30(1), 115-127.
29. Friedman, M., & Savage, L. J. (1948). The Utility Analysis of Choices Involving Risk. *Journal of Political Economy*, 56(4), 279-304
30. Fu, F. (2009). Idiosyncratic risk and the cross-section of expected stock returns. *Journal of Financial Economics*, 91(1), 24-37.
31. Godfrey, M.D., Granger, C. W. J., & Morgenstern, O. (1964). The Random Walk Hypothesis of Stock Market Behavior. *Kyklos*, 17(1), 1–30.
32. Goyal, A., & Santa-Clara, P. (2003). Idiosyncratic risk matters! *The Journal of Finance*, 58(3), 975-1007.
33. Hu, C., & Wang, Y. (2013). Noise trading and stock returns: evidence from China. *China Finance Review International*, 3(3), 301-315.
34. Kahneman, D. (2003). Maps of bounded rationality: Psychology for behavioral economics. *American Economics Review*, 93(5), 1449– 1475.
35. Kahneman, D., & Riepe, M. W. (1998). Aspects of investor psychology. *Journal of portfolio management*, 24(4), 52-65.
36. Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 47(2), 263-291.
37. Kahneman, D., & Tversky, A. (1992). Conflict Resolution: A Cognitive Perspective. In E. Shafir (Ed.), *Preference, Belief, and Similarity: Selected writings*, Massachusetts, 729-746.
38. Kim, D. & S. J. Kon. (1994). Alternative models for the conditional heteroscedasticity of stock returns. *Journal of Business*, 67(4), 563-598;
39. Kroll, Y., Levy, H., & Rapoport, A. (1988). Experimental tests of the separation theorem and the capital asset pricing model. *American Economic Review*, 78(3), 500– 518.
40. Larrick, R. P., Heath, C., & Wu, G. (2009). Goal-induced risk taking in negotiation and decision making. *Social Cognition*, 27(3), 342-364.
41. Li, X., Miffre, J., Brooks, C., & O’Sullivan, N. (2008). Momentum profits and time-varying unsystematic risk. *Journal of Banking & Finance*, 32(4), 541-558.

42. Lo, A. W. (2005). Reconciling Efficient Markets with Behavioral Finance: The Adaptive Markets Hypothesis. *Journal of Investment Consulting*, 7(2), 21-44.
43. Lopes, L. L. (1987). Between hope and fear: The psychology of risk. *Advances in Experimental Social Psychology*, 20(1), 255-295.
44. Lopes, L. L., & Oden, G. C. (1999). The role of aspiration level in risky choice: A comparison of cumulative prospect theory and SP/A theory. *Journal of mathematical psychology*, 43(2), 286-313.
45. Markowitz, H. (1952a). Portfolio selection. *Journal of Finance*, 7(1), 77-91.
46. Markowitz, H. (1952b). The utility of wealth. *Journal of Political Economy*, 60 (), 151-158.
47. Markowitz, H. M. (1956). The Optimization of a Quadratic Function Subject to Linear Constraints. *Naval Research Logistics Quarterly*, 3 (1-2), 111–133.
48. Markowitz, H. M. (1959). *Portfolio Selection: Efficient Diversification of Investments*. John Wiley & Sons, New York.
49. Markowitz, H. M. (1987). *Mean–Variance Analysis in Portfolio Choice and Capital Markets*. Oxford, U.K.: Basil Blackwell.
50. Markowitz, H. M. (1991). *Portfolio selection: efficient diversification of investment*, Blackwell, Cambridge, Mass.
51. Merton, R. (1972). An analytic derivation of the efficient portfolio frontier. *Journal of Financial and Quantitative Analysis*, 7(6), 1851-1872.
52. Milan, P. L. A. B., & Eid Jr, W. (2017). Investment Portfolios in an Emerging Economy: What Drives Portfolio's Diversification?. *EMAJ: Emerging Markets Journal*, 7(1), 1-10.
53. Mouna, A., & Anis, J. (2015). The factors forming investor's failure: Is financial literacy a matter? Viewing test by cognitive mapping technique. *Cogent Economics & Finance*, 3(1), 1057923.
54. Nassirtoussi, A. K., Aghabozorgi, S., Wah, T. Y., & Ngo, D. C. L. (2014). Text mining for market prediction: A systematic review. *Expert Systems with Applications*, 41(16), 7653-7670.
55. Nevins, D. (2004). Goals-based investing: Integrating traditional and behavioral finance. *The Journal of Wealth Management*, 6(4), 8-23.
56. Pfiffelmann, M., Roger, T., & Bourachnikova, O. (2016). When behavioral portfolio theory meets Markowitz theory. *Economic Modelling*, 53(3), 419-435.

57. Ritter, J. R. (2003). Behavioral finance. *Pacific-Basin finance journal*, 11(4), 429-437.
58. Roy, A. D. (1952). Safety first and the holding of assets. *Econometrica: Journal of the econometric society*, 20(3), 431-449.
59. Sahi, S. K., Arora, A. P., & Dhameja, N. (2013). An exploratory inquiry into the psychological biases in financial investment behavior. *Journal of behavioral finance*, 14(2), 94-103.
60. Shefrin, H. (2002). *Beyond greed and fear: Understanding behavioral finance and the psychology of investing*. Oxford University Press on Demand.
61. Shefrin, H., & Statman, M. (2000). Behavioral portfolio theory. *Journal of Financial and Quantitative Analysis*, 35(2), 127–151.
62. Sinha, P.C. (2015). Dynamics of Noise Traders' Risk in the NSE and BSE Markets. *International Journal of Financial Management*, 5(4), 36-64.
63. Sinha, P.C. (2016). Herd Behavior: How Decisive is the Noise in the NSE and BSE Stock Markets? *International Journal of Financial Management*. 6(1), 1 – 16; January, 2016.
64. Sinha, P.C. (2018). Investors' Trading Biases and Information: Experimental Analysis. *International Journal of Exclusive Management Research*, Special Issue, January – 2018, 35-56. Source: <http://ijemr.in/wp-content/uploads/2018/03/Content-1.pdf>
65. Slovic, P. (1972). Psychological study of human judgment: Implications for investment decision making. *The Journal of Finance*, 27(4), 779-799.
66. Statman, M. (2000). Socially responsible mutual funds (corrected). *Financial Analysts Journal*, 56(3), 30-39.
67. Statman, M. (2004). The diversification puzzle, *Financial Analysts Journal*, 60(4), 44-53.
68. Statman, M., Fisher, K. L., & Anginer, D. (2008). Affect in a behavioral asset-pricing model. *Financial Analysts Journal*, 64(2), 20-29.
69. Statman, M., Thorley, S., & Vorkink, K. (2006). Investor overconfidence and trading volume. *The Review of Financial Studies*, 19(4), 1531-1565.
70. Telser, L. G. (1955). Safety first and hedging. *The Review of Economic Studies*, 23(1), 1-16.
71. Thaler, R. (1985). Mental Accounting and Consumer Choice, *Marketing Science*, 4(3), 199-214.

72. Thaler, R. H. (1999). Mental Accounting Matters. *Journal of Behavioral Decision Making*, 12(3), 183-206.
73. Tuyon J., & Ahmad Z. (2016). Behavioural finance perspectives on Malaysian stock market efficiency, *Borsaistanbul Review* (2016), doi: 10.1016/j.bir.2016.01.001.
74. Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, 5(2), 207-232.
75. Tversky, A., & Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases. Biases in judgments reveal some heuristics of thinking under uncertainty. *Science*, 185 (4157), 1124-1131.
76. Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science*, 211(4481), 453-458.
77. Tversky, A., & Kahneman, D. (1992). Advances in Prospect Theory: Cumulative Representation of Uncertainty, *Journal of Risk and Uncertainty*, 5(4), 297-323.