ISSN 2090-3359 (Print)
ISSN 2090-3367 (Online)

Advances in Decision Sciences

Volume 25
Issue 4
December 2021

Michael McAleer

Editor-in-Chief
University Chair Professor
Asia University, Taiwan

Published by Asia University, Taiwan

ADS@ASIAUNIVERSITY

Review on Behavioral Finance with Empirical Evidence

Tai-Yuen Hon[1], Massoud Moslehpour[2,3], Kai-Yin Woo[4]*

[1] Business, Economic and Public Policy Research Centre, Hong Kong Shue Yan University, Hong Kong

[2] Department of Business Administration, Asia University, Taichung, Taiwan

[3] Department of Management California State University, San Bernardino, California, USA

[4] Department of Economics and Finance, Hong Kong Shue Yan University, Hong Kong

*Corresponding author Email: kywoo@hksyu.edu

Abstract

Purpose. When many anomalies challenge efficiency market hypothesis and rationality, behavioral finance theories are developed to investigate the psychological effects on human behaviors and how their cognitive biases explain why the market is inefficient and anomalies exist. Behavioral finance is a fast-growing branch of financial economics, making this review paper beneficial to academics for developing leading-edge usages of financial theory that behavioral finance underlies and undertaking empirical studies on behavioral finance models. This review paper indoctrinates readers into the introductory concepts of behavioral finance with their prominent literature and empirical evidence.

Design/methodology/approach. In this review paper, we swiftly familiarize readers with the introductory concepts of behavioral finance and their salient readings with some empirical evidence.

Findings. This paper lays the solid foundation of behavioral finance theory and is the centerpiece of modern financial economics, which is useful to academics for developing cutting-edge treatments of financial theory that EMH and behavioral finance underpin and for undertaking empirical studies on the behavioral bias in the financial markets.

Practical Implications. This paper is furthermore helpful to investors in making investment products and strategy choices that suit their risk preferences and behavioral traits predicted from behavioral models. This paper also provides the recent empirical evidence of behavioral finance in literature. The readers can then follow the research methods to undertake empirical studies on this field.

Keywords: prospect theory, heuristic, risk-seeking, behavioral bias

Paper type: Research paper

JEL classifications: G10, G40

1. INTRODUCTION

In the traditional finance framework, where market participants are rational and frictionless, an asset price is equal to its intrinsic value. The intrinsic value is the present value of all expected future cash flows from the asset, where rational expectations are formed with all available information and where the discount rate is consistent with a normatively acceptable preference specification (Barberis and Thaler, 2003). The hypothesis that actual prices, at any point in time, already reflect the effects of all available information and, therefore, will be good estimates of their intrinsic values is known as the Efficient Markets Hypothesis (EMH). Under the EMH, investors cannot adopt any investment strategies to make abnormal risk-adjusted returns on the average or make the expected returns more than buy-and-hold (Fama, 1970). Moreover, EMH is important for understanding asset pricing theory (Jarrow, 2012) and option pricing theory (Jarrow, 2013; Bhattacharya, 2019). However, many studies are full of evidence of anomalous behaviors in the market that challenge market efficiency (Woo et al., 2020). Fama (1998) defends against the critiques of EMH and argues that the anomalies are occasional events and chance results, that apparent overreaction to information is about as common as underreaction, that post-event continuation of pre-event abnormal returns is about as frequent as post-event reversal, and that the existence of anomalies depends upon the choice of the methodology used to estimate excess returns. The anomalies, in the long run, are then predicted to disappear.

There is a vast amount of literature on empirical testing of EMH. For example, Kung and Wong (2009) use two technical trading rules to assess whether the efficiency of Taiwan's securities market has improved due to the gradual liberalization measures implemented over the last decades. Their results favor the evidence of market efficiency. Vieito et al. (2013) are amongst the first to test for weak-form efficiency of the G-20 countries, with serial correlation test, ADF unit root test and multiple variance ratio tests employed for the empirical study. It is concluded that most of the individual markets are weak-form efficient.

On the other hand, stochastic dominance tests have been developed recently for testing EMH. Bai et al. (2011), Bai et al. (2015), Ng et al. (2017) and others have developed stochastic dominance tests used to examine whether the market is efficient. Lean et al. (2010) apply the stochastic dominance test to

examine the EMH of oil spot and futures prices and conclude that the spot and futures oil markets are efficient and rational. Chan et al. (2012) apply the stochastic dominance approach to examine the efficiency of the UK covered warrants market and do not reject market efficiency. Clark et al. (2016) cannot reject EMH using the stochastic dominance test. Zhu et al. (2019) apply the stochastic dominance test to analyze the impacts of the most recent global financial crisis on the seven most important Latin American stock markets and conclude that the markets are efficient.

Moreover, Fong et al. (2005) apply a stochastic dominance test to distinguish between two hypotheses that there exist general asset pricing models explaining the momentum effect versus the alternative hypothesis that no asset pricing models are consistent with risk-averse investors rationalizing that momentum effect. They find that the search for rational asset pricing explanations for the momentum effect may be unsuccessful and then reject the existence of an efficient market. Wong et al. (2008) and others have claimed that if the first-order stochastic dominance exists statistically, there could be arbitrage opportunity, and investors can increase their expected wealth and expected utility if they switch from holding the dominant to the dominant assets. Tsang et al. (2016) use the stochastic dominance method for analysis and find an arbitrage opportunity in the real estate market of Hong Kong by considering rental yield in this market. Finally, Guo et al. (2017a) adopt stochastic dominance and Omega ratio to examine market efficiency. They find that the real estate market in Hong Kong is not efficient with expected arbitrage opportunities and anomalies. Many approaches can be used to examine market efficiency. Readers may refer to Wong (2020, 2021), Woo et al. (2020), and others for more information.

The arguments for and against the EMH continue in the literature. The skeptics of EMH integrate the effects of psychological, cognitive, emotional and economic factors on the decisions of investors, financial analysts and financial institutions, which are different from the predictions of traditional finance theory. The new branch of financial economics, known as behavioral finance, is increasingly important in the literature and questions the EMH (Thaler, 2015). Unlike the EMH, behavioral finance argues that asset prices are likely to deviate from their fundamental values, and these deviations are caused by the presence of traders whose rationality is bounded by behavioral bias (Barberis and Thaler, 2003). Understanding behavioral finance concepts

are essential for developing cutting-edge treatments of financial economics. In this paper, we review brief behavioral finance concepts with their salient readings so that readers can grasp the basic ideas quickly, which are needed to go further in their studies on behavioral finance at a more advanced level (Venezia, 2018). We also provide the recent empirical evidence of behavioral finance in the literature. The readers can then follow the research methods to undertake empirical studies on this field.

The rest of the paper is organized as follows: Section 2 illustrates behavioral finance concepts with empirical evidence in the literature. Finally, section 3 presents the concluding remarks.

2. BEHAVIORAL FINANCE

Behavioral finance studies the effect of psychological factors on human behavior, which further affects asset price movements. Standard financial models assume that individuals are rational and risk-averse. In reality, individuals may be however irrational and risk-seeking. For example, Li and Wong (1999), Wong and Li (1999), Wong (2006, 2007), Wong and Ma (2008), Guo and Wong (2016), Chan et al. (2020), and many others consider that investors could be risk-averse or risk-seeking. Behavioral finance models do not adhere to the traditional assumptions of rationality and risk aversion but investigate how irrationality and behavioral bias affect our decisions. Well-known concepts with some selected empirical evidence in the literature are briefly reviewed below to enhance the understanding of behavioral finance.

2.1. The Prospect Theory

Tversky and Kahneman (1981) consider that individuals could be judged irrational either because their preferences are contradictory or because their desires and aversions do not reflect their pleasures and pains. Prospect theory developed by Kahneman and Tversky (1979) is used to explain irrational behavior under risk and uncertainty due to cognitive bias. The theory tries to model real-life choices among risky prospects that are inconsistent with the basic tenets of expected utility theory rather than an optimal decision.

The prospect theory begins with the value function from which people react differently when faced with potential gains and losses. The value function is

concave for gains, convex for losses, and is generally steeper for losses than for gains indicating that losses outweigh gains. Under the prospect theory, people make decisions based on the potential gains or losses relative to their reference point rather than absolute wealth values. The status quo is usually taken as the reference point as it is found that investors use the purchase price as a reference point, but there are situations in which gains and losses are coded relative to an expectation level that is different from the status quo. For example, when faced with a risky prospect leading to gains, people are risk-averse with a concave value function. Hence, they prefer choices with a higher certainty. In contrast, when faced with a risky choice leading to losses, people become risk-seeking with a convex value function. Accordingly, they prefer the outcomes to avoid the sure losses. These concepts are contractionary to the rational theory of expected utility maximization.

According to the prospect theory, the value is assigned to gains and losses rather than final wealth. The value function that passes through the reference point is then S-shaped and asymmetrical. Also, the value function is steeper for losses than gains indicating that losses outweigh gains due to loss aversion, which is considered a main behavioral bias under the prospect theory (Selim et al., 2015). This theory differs from the expected utility theory, in which a rational agent is indifferent to the reference point, and people do not care how the outcome of losses and gains is framed. Furthermore, unlike the expected utility theory, the probabilities are replaced by probability weighting functions when the expected utility is estimated. However, the model is based on observations that low probabilities are usually overweighted, and high probabilities are usually underweighted. It is consistent with the observation that people tend to overreact to low probability and underreact to high probability. It is observed that overweighting of low probabilities may also contribute to the attractiveness of both the insurance and gambling industries. Prospect theory has laid solid foundations of behavioral finance and has led to the influential development of financial theory in the literature. For example, Levy and Levy (2002), Wong and Chan (2008), Levy and Orkan (2012), and others extend the stochastic dominance theory to fit into the prospect theory. Barberis (2013) provides more insights on the prospect theory.

Zhang and Semmler (2009) explore evidence on the prospect theory for stock markets with time-series data, and they find that gains and losses may have

asymmetric effects on investment behavior under the prospect theory. Gasbarro et al. (2012) adopt ascending and descending stochastic dominance procedures to test for risk-averse and risk-seeking behavior. They find evidence of all four utility functions: concave, convex, S-shaped, and reverse S-shaped. Abdellaoui et al. (2013) undertake an experimental study in which a sample of private bankers and fund managers behave according to prospect theory and violate expected utility maximization. Finally, Liu et al. (2014) test the prospect theory by analyzing over 28.5 million trades made by 81.3 thousand traders of an online financial trading community over 28 months. The results support the unprecedentedly large-scale evidence of prospect theory in online financial trading. The finance professionals are suggested to develop trading strategies to reduce the impacts of loss aversion and disposition under the prospect theory.

2.2 Mental accounting

Mental accounting (or psychological accounting) refers to the different values people place on money based on subjective criteria, leading people to make irrational decisions (Thaler, 2015). When framing refers to how a problem is posed for decision-makers, one important feature of mental accounting is narrow framing, which treats individual gambles separately from other portions of wealth (Barberis and Thaler, 2003). Then, people tend to separate decisions that should be combined according to the principle of rationality. Gains and losses are treated separately so that, as predicted by the prospect theory, people are risk-averse when they gain but risk-seeking when they experience loss. For example, individuals have an everyday budget for food and a family budget for entertaining. Therefore, they will not eat expensive food such as lobster or shrimp at home, where the food budget for food is limited because lobster and shrimp are much more expensive than a simple fish dish. However, they will order lobster and shrimp in a restaurant for entertainment even though the cost is much higher than a simple fish dish. If they instead ate lobster and shrimp at home but the simple fish dish in a restaurant, they could save money. However, they would not do so because they budget money into mental accounts for expenses (Zhang and Sussman, 2018) and then think separately about restaurant meals and food at home. As a result, they would choose to limit their food at home (Ritter, 2003).

Lim (2006) shows that investors prefer integrating losses and segregating gains consistent with the mental accounting concepts of Thaler (1985).

Milkman and Beshears (2009) estimate the amounts of online grocery purchases with and without coupons redeemed. They observe a rise in grocery spending with coupon redemption and the additional expenditure associated with coupon redemption on groceries that a buyer does not typically purchase. These results support the evidence of mental accounting. Egozcue and Wong (2010) use the ideas of mental accounting, prospect theory and others to develop a model that can explain investors' behavior in segregating or integrating multiple outcomes when evaluating mental accounting. Egozcue et al. (2014) further extend the theory by using the ideas of mental accounting, prospect theory and others to develop decision rules for multiple products. Finally, Sui et al. (2021) explore how overspending behaviors are related to the mental accounts of wealth, saving goals and expense forecasting. Overspending behavior associated with these three kinds of mental accounts reveals evidence that the expected overspending is susceptible to expenditure forecasts and wealth allocation. In contrast, wealth allocation affects credit overspending, and income overspending is subject to wealth allocation, expenditure forecasts, and savings goals.

2.3 Time preference and self-control

The conventional representation of decision making over time is usually modelled by an additively separable utility function with exogenous, declining exponential weights. However, evidence from psychological research proposes that discount rates are dependent upon a range of psychological variables such as consideration of future consequences, conscientiousness, extraversion, experiential avoidance, and self-control (Daly et al., 2009). For example, deferring consumption involves consumer self-control and is linked to mood and emotional states. It is found that discount rates are sometimes bizarrely high, that gains are discounted more heavily than loss, that small magnitudes are discounted more heavily than large magnitudes, that the framing of choice as a delay versus an advance has a large effect on decisions, that time preference differs greatly in different judgment domains (e.g., money versus health). Those visceral influences such as pain or hunger affect inter-temporal choices (Hirshleifer, 2001). Moreover, Barber and Odean (2008) propose an alternative model of decision making in which agents faced with many alternatives consider primarily those options that have attention-attracting qualities. Preferences come into play only after attention has limited the choice set. When options are numerous and search

costs high, attention, rather than preferences, may affect choice-making decisions.

2.4 Regret aversion and disposition effect

If information about the best course of action under uncertainty arrives after taking a fixed decision, the negative human emotion of regret is often experienced. Loomes and Sugden (1982), Bell (1982), and Fishburn (1982) were the first to develop the regret theory. Regret is the pain that people feel when they consider themselves better off if they had not taken a certain action in the past. The value of regret can be measured as the difference between a made decision and the optimal one. The theory of regret proposes that when facing a decision in an uncertain environment, the regret-averse individuals incorporate the possibility of regret in their decision-making process to avoid its occurrence. Seiler et al. (2008) examine the regret aversion in residential real estate markets. They find that in a hypothetical situation, people would experience higher regret if they do not sell their investment property at the all-time high than if they are simply unaware of the potential gain, and that women are more averse to regret than men.

Many scholars have contributed to the advancement of this theory. Egozcue et al. (2015) develop a model to obtain the optimal output of a competitive firm, assuming that the firm is regret-averse when it faces price uncertainty. They discover that under certainty, the optimal output will be lower for regret-averse firms than for risk-averse firms. They also show that the optimal output will change when the regret factor changes. Furthermore, Guo et al. (2015) investigate hedging behaviors for regret-averse firms in their production. They prove that the separation theorem works well, but the full-hedging theorem does not work well under the regret-averse model. They demonstrate that regret aversion behavior is not related to optimal production levels and that regret-averse firms take different hedged positions compared to risk-averse firms in some circumstances. When firms are more regret-averse in an unbiased futures market, they will take less optimal hedging positions. Furthermore, contrary to the conventional theory, they indicate that regret-averse firms change their production level when forward trading is prohibited. Guo and Wong (2019) extend the theory by first demonstrating that linear-regret firms will produce less than firms under certainty and produce more than risk-averse firms for sure. They provide sufficient conditions for regret-averse firms to produce more than both

linear-regret and risk-averse firms and develop properties on the comparative statics of optimal production and the production of regret-aversion firms. Qin (2020) proposes a regret-based capital asset pricing model in which investors maximize the expected portfolio returns while minimizing anticipated regrets. In equilibrium, a risky asset's excess return is proportional to its regret beta that measures the exposure to investors' emotions, and the investors are expected to receive a positive regret premium as compensation for regret aversion. Finally, Ballinari and Müller (2021) test the relationship between regret aversion theory and US stock returns. From their test results, stocks that have a high regret measure offer a low potential for regret. Thus, investors increase the portfolio weight towards these stocks that become overvalued today from the perspective of regret aversion theory and will have low subsequent average returns. The same logic of the argument is applied to the stocks with a low regret measure. These empirical results are consistent with the regret-based capital asset pricing model (Qin, 2020), which predicts that stocks with a high potential for future regret will offer higher average returns in the future.

On the other hand, the regret and the prospect theory have also been extended to explain the disposition effect (Fogel and Berry, 2006). Shefrin and Statman (1985) identify the disposition effect, which considers that investors dislike incurring losses more than they like making profits, and they are eager to gamble on losses. As a result, investors will tend to sell assets that have risen in value but keep assets which prices have declined. In other words, they sell winners rather than losers. The cause of the disposition effect can be explained by the prospect theory mentioned above, which shows that investors are risk-averse when they earn profits but are risk-seeking when incurring losses. Hence, risk-seeking investors tend to keep the losing investments to later bet on the possible rebound in the face of loss. They do so also because they want to avoid the feeling of regret when they realize a loss from making a wrong investment decision previously or when the price rebound occurs after the sale of losing investments.

Choe and Eom (2009) examine whether the disposition effect exists in the Korean stock index futures market. Their findings show strong evidence for the disposition effect. Also, individual investors are much more prone to the disposition effect than institutional and foreign investors. Sophistication and trading experience help reduce the disposition effect. Moreover, the

disposition effect is stronger in long positions than in short positions. The conclusion is that the disposition effect may reduce the investment performance. The above results are consistent with Odean (1998). As presented in Kaustia (2010), empirical results indicate strong evidence for the disposition effect in stock and other asset markets. Household investors are generally more susceptible to the disposition effect than professional investors. The disposition effect is responsible for stock market underreactions and price momentum. Moreover, from Birru's (2015) research study, the disposition effect exists prior to stock splits but is absent following a stock split. It is because oblivious investors cannot properly account for changes in nominal share price due to stock splits and cannot accurately identify the winners and losers. Moreover, momentum is still present even though the disposition effect disappears following a stock split. Therefore, it implies that momentum may be induced by factors aside from the disposition effect. Furthermore, by collecting quantitative data through a questionnaire survey and adopting a structural equation modeling method, Chang (2020) finds that mental accounting has the most significant influence on the disposition effect. The results also show that female investors exhibit a larger disposition effect than male investors.

2.5 Disappointment theory

Disappointment, a source of psychological stress, refers to the feeling of dissatisfaction associated with the failure of hope. It is observed that people considering risks when making decisions are disappointed when the outcome of the risk is not evaluated as positively as the expected outcome. Bell (1985) and Loomes and Sugden (1982) were the first to introduce the disappointment theory, which states that individuals will become disappointed discovering that the outcome is worse than they expected, and they will be elated if the outcome is better larger than they expected. People are then averse to disappointment. The theory of disappointment explains why the disappointment-averse people are more likely to choose a certain reward than to risk a greater reward while at the same moment they are eager to choose a greater reward with lower probability when both choices include some risk (Gul, 1991). Readers are suggested to consult Guo et al. (2021) for more information about the disappointment theory.

The empirical study of Xie et al. (2016) supports the view that disappointment aversion leads to the reduction of investors' exposure to the stock markets and indicates that disappointment aversion and risk aversion can significantly explain the global equity premium puzzle. Li et al. (2021) study a consumption-based asset pricing model with disappointment aversion and argue that disappointment aversion is playing an important role for leading to a low risk-free rate and a high equity premium.

2.6 Cognitive dissonance

Cognitive dissonance is the perception of contradictory information and the relevant information items include people's actions, feelings, ideas, beliefs, and values, and things in the environment (Festinger and Carlsmith, 1959). Hence, cognitive dissonance is a mental conflict that people experience when presented with evidence that their beliefs, values, or assumptions are wrong. Cognitive dissonance is then classified as the pain of regret over erroneous beliefs. The theory of cognitive dissonance asserts that people tend to reduce the cognitive dissonance that is considered irrational. For instance, they may avoid the new information or develop contorted arguments to maintain their beliefs or assumptions. Also, investors avoid negative information about a stock they purchased and focus upon its positive news only (Akerlof and Dickens, 1982; Shiller, 2001). Simo et al. (2020) observe that managers' IPO indeterminacy can be explained by cognitive dissonance bias, and financial literacy helps reduce cognitive dissonance.

2.7 Money illusion

Money illusion refers to the confusion between real and nominal values. The individuals subject to this bias tend to make economic decisions based on nominal rather than real variables (Fisher, 1928). The existence of money illusion violates the assumption of the rational decision-making process.

Discounted real cash flows at real rates or nominal cash flows at nominal rates can help determine the stock values in a rational model. However, during high inflationary periods, it is possible that investors mistakenly discount real cash flows at nominal rates. If inflation increases, so will the nominal discount rate. If investors discount the same set of cash flows at this higher rate, they will push the stock market's value down. This calculation is incorrect because inflation should have a little net effect on the market value when the same inflation which pushes up the discount rate should also push up future cash

flows. Such money illusion may therefore cause variation in Price-Dividend ratios and returns. This illusion seems particularly relevant to understanding the low (high) market valuation during the high (low) inflation periods (Barberis and Thaler, 2003). Furthermore, in experimental asset markets, Noussair et al. (2012) find an effect of a nominal shock on real prices. Also, there is an asymmetric response of real prices to inflationary and deflationary nominal shocks, and the deflationary shock has a larger effect on real prices when compared with an inflationary one. These two empirical phenomena can be explained by money illusion.

2.8 Availability heuristic

The availability heuristic (or availability bias) is a mental shortcut that relies on immediate information to a given person's mind when assessing a specific topic, concept, method, or decision (Tversky and Kahneman, 1973). Hence, if something or some memory can be recalled, people would think that it must be important, or at least more important than others that are not as readily recalled. The availability heuristic operates when limited attention, memory and processing capacities focus only on subsets of available information. Unconscious associations also create focus. Selective triggering of association causes salience and availability effects. An information signal is salient if it has special characteristics that are good at grabbing hold of our attention or at creating associations that facilitate recall. In the availability heuristic, items or events that are easier to recall are more common. Under the availability heuristic, investors tend to heavily weigh their judgments toward more recent information about a stock's prospects, and investment decisions are made irrationally toward that latest news. The attention of the internet revolution is an empirical example of an availability heuristic that might lead to the market boom of the late 1990s (Hirshleifer, 2001).

Kudryavtsev (2018) investigates the effect of the availability heuristic on subsequent stock returns. The empirical findings document that when there is a major positive (negative) change in stock price, its magnitude would be enlarged by the availability of positive (negative) investment outcomes. The availability heuristic would cause price overreaction to the initial company-specific shock, leading to a subsequent price reversal.

2.9 Representative heuristic

The representative heuristic (Tversky and Kahneman, 1974) involves estimating the likelihood of an event in the face of uncertainty, which depends on the degree to which the evidence is perceived to be similar to or typical of the state of the world. People's perceptions of how "representative" a piece of evidence is of a state of the world may be inaccurately related to its conditional probability. People, for example, tend to rely too heavily on small samples and too little on large samples, inadequately discount for the regression phenomenon and selection bias in the generation or reporting of evidence (Hirshleifer, 2001). Under the representative heuristic, people usually make biased judgments because something more representative does not make it more likely. Companies with very low P/E ratios, for example, are thought to be temporarily "undervalued" because investors become overly pessimistic after a string of bad earnings reports or other bad news. The price will adjust if future earnings prove better than the overly pessimistic forecasts. Similarly, equity in companies with high P/E ratios is thought to be temporarily "overvalued" before falling in price (De Bondt and Thaler, 1985).

Lam et al. (2010) employ a pseudo-Bayesian approach to accounts for investors' behavioral biases on the weight assignments of the dividends (Thompson and Wong, 1991, 1996; Wong and Chan, 2004). Their model can explain various financial anomalies, such as short-run underreaction, long-run overreaction, magnitude effect, and excess volatility. Lam et al. (2012) add more properties to the pseudo-Bayesian model and explain the relationship between investors' behavioral biases and market anomalies. Guo et al. (2017b) extend the model further and develop some properties to explain excess volatility, short-term underreaction, long-term overreaction, and their magnitude effects during financial crises and subsequent recovery, by assuming that the earnings shock follows an exponential family distribution and the earnings shock of an asset follows a random walk model with and without drift. In a questionnaire survey, Wong et al. (2018) research Hong Kong small investors' conservative and representative heuristics who use momentum or contrarian trading strategies to see whether the theory holds empirically. The study indicates some evidence of representative heuristics.

2.10 Overconfidence

Overconfidence is a behavioral bias in which an individual's subjective confidence in his judgments is reliably larger than the

factual accuracy of those judgments, especially when confidence is relatively high. Overconfidence implies over-optimism about the individual's ability to succeed in his endeavors. Whether investors who are overconfident and misjudge asset returns have long been wondered can still survive in a competitive asset market. Kyle and Wang (1997) have demonstrated that overconfidence could strictly outperform rationality because an overconfident trader can generate more expected profit and utility than his rational opponents and more than if he was also rational. In a standard Cournot duopoly model, overconfidence functions as a commitment device. As a result, the Nash equilibrium of a two-mutual fund game is a Prisoner's Dilemma in which both mutual funds hire overconfident managers. Overconfidence can thus persist and thrive in the long run. Daniel et al. (1998) propose a theory based on investor overconfidence and changes in confidence due to biased self-attribution of investment outcomes. According to the theory, investors will overreact to private information signals while underreacting to public information signals. Gervais and Odean (2001) develop a multi-period market model describing the process by which investors learn about their ability and how a bias in this learning can create overconfident investors. An investor assesses his ability from the number of past successes and failures. When the investor takes too much credit for his successes, it leads him to be overconfident. Overconfidence cannot make the investors wealthier, but the process of accumulating wealth can make investors overconfident. Overconfidence is caused by investors' success so that the overconfident investors can survive in the market.

Also, Odean (1998) discovers that market agents are overconfident, including price-taking traders, strategic-trading insiders and risk-averse market-makers. Overconfidence increases expected trading volume and market depth and it also decreases overconfident traders' expected utility. Benos (1998) investigates an extreme form of posterior overconfidence where some risk-neutral investors overestimate the precision of their private information. The participation of overconfident traders in the market leads to higher transaction volume, larger depth, more volatility, and more information prices. For example, Odean (1999) notes that the annual turnover rate of shares on the New York Stock exchange is greater than 75 percent, and the daily trading volume of foreign-exchange transactions in all currencies (including forwards, swaps, and spot transactions) is equal to about one-quarter of the total annual world trade and investment flow. Odean (1999)

presents data on individual trading behavior, which suggests that extremely high volume may be driven, in part, by overconfidence on the part of investors. Excessive trading behavior may reduce the net returns in the market (Barber and Odean, 2000). In the theoretical framework of Gervais and Odean (2001), overconfident investors are predicted to trade excessively, resulting in large trading volume and market volatility. Likewise, Statman et al. (2006) empirically confirm the proposition that investors are overconfident about their valuation, and trading skills can explain high observed trading volume. On the other hand, the researches undertaken by Hirshleifer (2001) and Barber and Odean (2001) show that men are more likely to be overconfident than women.

The empirical study of Li and Hung (2013) on a sample of Taiwan-listed companies indicates that overconfident managers are more likely to take part in earnings management behaviors, and there are negative moderating effects of family control on the relationship between managerial overconfidence and earnings management, which arise from family CEOs. Jlassi et al. (2014) investigate the effect of overconfidence behavior on volatility in international financial markets. The study documents the evidence of overconfidence which is more significant in the developed markets than in the emerging ones. Overconfidence is found in both up and down markets, except in some Asian and Latin American markets. Overconfidence is also the main factor leading to the global financial crisis, and it still exists even during the recession period. Moreover, the theoretical and empirical investigation of overconfidence in real estate markets is extensively studied by Bao and Li (2016), which document many cases of overconfidence. Ho et al.'s (2016) study indicate that banks with overconfident CEOs are more likely to increase banking lending and leverage than other banks before the financial crisis. During crisis years, the business performance of these banks is generally more disastrous, leading to a higher likelihood of CEO turnover or failure than other banks. The empirical test of He et al. (2019) shows that internal financing can fund business opportunities and alleviate capital shortages for the listed companies in China but may also cause excessive investment, especially in companies with managerial overconfidence. This overinvestment problem related to managerial overconfidence is more serious in state-owned than non-state enterprises. From the findings of Tang et al. (2020), young and male CEOs usually enhance the impact of CEO overconfidence on a firm's value after mergers and acquisitions in China.

2.11 Anchoring and adjustment

The anchoring effect is a cognitive bias whereby a particular reference point or anchor influences an individual's decisions. In many situations, once an anchor is set, people will adjust away from it to get to their final solution. However, they adjust insufficiently, and the final guess becomes closer to the anchor than otherwise. In other words, different anchors yield different estimates, which are biased toward the anchors. We call this phenomenon anchoring-and-adjusting (Tversky and Kahneman, 1974), under which investors initially have in their minds some reference points or anchors such as previous stock prices, and then they adjust this past their reference points but insufficiently due to underreaction to new information acquired. Anchoring describes how individuals tend to focus on recent behavior and give less weight to longer-time trends. Einhorn and Hogarth (1986) have developed a model of assessing uncertainty in ambiguous situations. The basic idea is that people use an anchoring–and–adjusting strategy in which an initial probability is used as the anchor (or reference point), and adjustments are made for ambiguity. The anchor probability can come from various sources; it may be a probability that is impressive in memory, the best guess of experts, or a probability that is otherwise available. Psychologists have documented that when people make quantitative estimates, they may be heavily influenced by previous values of the item. For example, a used car salesman always starts negotiating with a high price and then works down. The salesman is trying to get the consumer anchored on the high price so that when he offers a lower price, the consumer will estimate that the lower price represents good value. Furthermore, anchoring can cause investors to underreact to new information (Fuller, 1998). Values in speculative markets, like stock markets, are inherently ambiguous. It is hard to tell the value of, for example, the Hang Seng Index in Hong Kong. There is no agreed-upon economic theory that would provide an answer to this question. In the absence of any better information, the anchor is usually the most recently remembered prices which are likely to be important determinants of prices today. The empirical study of Lieder et al. (2018) suggests that the anchoring bias results from people's rational use of their finite time and limited cognitive resources, rather than human irrationality. Furnham and Boo (2011) provide a detailed discussion of the anchoring effect.

2.12 Ambiguity aversion

Ambiguity aversion (or uncertainty aversion) refers to a preference for known risks over unknown risks. An ambiguity-averse individual would prefer a choice where the probability distribution is known rather than one with an ambiguous probability distribution. In financial markets, investors are usually uncertain about the probability distribution of an asset's return. The ambiguity-averse investor holds a range of possible probability distributions in mind and maximizes the minimum expected utility under any possible distribution. The investor has a reference probability distribution in mind but wants to ensure that his decisions are good ones even if the reference model is misspecified to some extent. Also, if the investor is concerned that his model of stock returns is misspecified, he will charge a substantially higher equity premium as compensation for the perceived ambiguity in the probability distribution (Barberis and Thaler, 2003). Guidolin and Rinaldi (2013) review theoretical treatments of portfolio choice, equilibrium asset prices, portfolio diversification and volatility of asset returns under ambiguity aversion.

The empirical study of Dimmock et al. (2016) discloses the negative correlation between investors' ambiguity aversion and stock market participation, the proportion of portfolio allocation to stocks, and foreign stock ownership. However, the correlation between ambiguity aversion and own-company stock ownership is positive. Ambiguity aversion is also related to portfolio under-diversification, and the ambiguity-averse investors are more likely to sell stocks during the financial crisis. Bianchi and Tallon (2019) indicate that ambiguity-averse investors bear excessive risk due to under-diversification, exhibit a home bias with higher exposure to the domestic relative to the international stock market, and also undertake portfolio rebalancing more actively and a contrarian strategy relative to past market trends in order to keep their risk exposure relatively steady over time. From the study of Dlugosch and Wang (2020), an increase in domestic ambiguity is associated with a fall in foreign bias that is greater for countries with more ambiguity aversion than countries with lower ambiguity aversion.

2.13 Ostrich effect

The ostrich effect (or the ostrich problem), a cognitive bias, refers to the investors' behaviors to avoid negative financial information, which brings psychological discomfort (Galai and Sade, 2006). Karlsson et al. (2009) present a model linking information collection to investor psychology. The model

predicts that investors collect additional information conditional on favorable news and avoid information following bad news. It is found that Scandinavian and American investors monitor their portfolios more frequently in bullish markets than when markets are flat or bearish in support of the evidence of the ostrich effect. Bernard et al. (2020) show that managers of retail dispensaries are susceptible to the ostrich effect when they are more likely to acquire store and product performance information. The ostrich effect will diminish if managers can more easily attribute the performance to external factors.

2.14 Herd effect

Herd behavior in social psychology refers to the behavior of individuals in a group acting collectively without centralized direction but could also be caused by correlated prevailing information in independently acting individuals. Hence, people will do what others are doing rather than optimal given their information. As a result, behavior patterns are correlated across individuals. For example, the concept of financial herd migration introduced by Patel et al. (1991) indicates that, like migrating birds and trekking wildebeest, which know that traveling in groups offers protection, financial players may migrate in herds such as when institutions increase their debt-equity ratio or their holdings of high-risk securities. However, the transition is slow because financial migration decision-makers must weigh the benefits of moving quickly toward the optimal situation against the cost of moving away from the herd.

On the other hand, herding describes a situation in which investors abandon their beliefs but adopt "moving with the market" or "following the general market trend" to earn excess returns. As a direct consequence, herd behavior leads to the development of trading strategies in financial markets, such as the momentum investment strategy, to outperform the market (Bikhchandani and Sharma, 2001). Alternatively, contrarian investors deliberately invest or speculate counter to the "herd" to earn an excess return.

Yao et al. (2014) test the herding behavior in the Chinese stock markets. The results indicate that investors exhibit different levels of herding behavior, and herding in the Chinese B-share markets is strong. Also, herding is more noticeable under bearish market conditions. Lee (2017) studies the herd behavior of the stock markets by proposing a new herding detection measure

based on cross-sectional excess co-movement of returns. Except during the US subprime crisis period, the results indicate strong evidence of herding during negative price movements bur with weak or no evidence of herding during periods of positive price movements. Ajaz and Kumar (2018) examine the existence of herd behavior in crypto-currency markets. Herding under up and down market is found, indicating over-enthusiasm and over-reaction. Also, herding depends on market activity rather than market volatility. Kudryavtsev (2019) investigates the effect of herd behavior on S&P 500 index returns. The study assumes that herding would lead to an overreaction of stock prices and subsequent price reversals. As a result, daily stock market returns are expected to be higher (lower) following negative (positive) market returns. The empirical evidence supports the herding effect on the stock market index returns by employing two herding measures. Cakan et al. (2019) test herding behavior in the South African housing market. A two-regime Markov switching model provides evidence of herding during the high volatility regime, indicating that herd behavior is driven by increased market uncertainty. The findings also suggest that policy uncertainty is associated with the presence of herding. Batmunkh et al. (2020) use a cross-sectional absolute deviation model to examine the presence of herd behavior in the Mongolian stock market. They find herd behavior in the full sample data, bull and bear market periods, and markets' high and low volatility states. They also find herd behavior in four important events: the establishment of the Finance Regulatory Committee of Mongolia, the Global Financial Crises, Mongolia's inclusion in the FTSE Russell Watch list and the economic boom in 2011. Liu et al. (2021) provide evidence of a herd effect in Chinese cross-border mergers and acquisitions activities. The political environment also generates a positive herd effect, but exchange rate volatility, degree of openness and cultural distances lead to negative herd effects. Finally, Choijil et al. (2022) analyze academic research on herd behavior in financial markets conducted over 30 years and show empirical evidence of herd behavior, especially following the subprime crisis. They conclude that there is no consensus regarding the causes of this phenomenon, but new perspectives have emerged from expanding research on herd behavior.

3. CONCLUSION

Unlike the standard finance paradigm, behavioral finance does not uphold the traditional assumption that individuals are fully rational but recognizes that their cognitive bias may limit rationality. Hence, behavioral finance models integrate ideas from cognitive psychology into economic and financial models and investigate how behavioral bias would affect the decisions made by not fully rational market agents in the financial markets (Thaler, 2015). As a result, the behavioral finance models can better explain and predict the phenomena of financial markets compared with the traditional finance in the literature. Daniel Kahneman, a pioneer in behavioral economics and finance; Eugene Fama, a strong proponent of EMH; Robert Shiller and Richard Thaler, important figures in the development of behavioral finance, were awarded the Nobel Prize in Economic Sciences. Their continual arguments for and against the existence of market efficiency and behavioral bias in the financial markets provide academics with a vast array of excellent reading materials for study. Shiller (2003) comments that financial economics had evolved a long way from the days when market efficiency was a pillar of finance to when behavioral finance is increasing its height of dominance in literature. Readers may refer to Alghaith et al. (2021) and Tiwari et al. (2021) for more theoretical descriptions and applications of behavioral finance.

In this review paper, we swiftly familiarize readers with the introductory concepts of behavioral finance and their salient readings, which lay the solid foundation of behavioral finance theory. These theories are the centerpiece of modern financial economics useful to academics for developing cutting-edge treatments of financial theory that EMH and behavioral finance underpin and for undertaking empirical studies on the behavioral bias in the financial markets. Furthermore, this review paper may be useful to investors for their investment strategies and policymakers for reviewing their policies for the development of financial markets.

CONFLICT OF INTEREST

There is no conflict of interest in this research

REFERENCES

Abdellaoui, M. Bleichrodt, H. and Kammoun, H. (2013). Do Financial Professionals Behave According to Prospect Theory? An Experimental Study, *Theory and Decision*, 74(3), 411-429.

Akerlof, G. and Dickens, W. (1982). The Economic Consequences of Cognitive Dissonance. *American Economic Review*, 72, 307–319.

Ajaz, T. and Kumar, A. S. (2018). Herding in Crypto-Currency Markets. *Annals of Financial Economics*, 13(2), 1-15.

Alghalith, M., Swanson, N., Vasnev, A. and Wong, W. K. (2021). Editorial Statement in Honour of Professor Michael McAleer, *Annals of Financial Economics*, forthcoming.

Bai, Z. D., Li, H., Liu, H. X. and Wong, W. K. (2011), Test Statistics for Prospect and Markowitz Stochastic Dominances with Applications, *Econometrics Journal*, 122, 1-26.

Bai, Z. D., Li, H., McAleer, M. and Wong, W. K. (2015), Stochastic Dominance Statistics for Risk Averters and Risk Seekers: An Analysis of Stock Preferences for USA and China, *Quantitative Finance*, 15(5), 889-900.

Ballinari, D. and Müller, C. (2021). Je ne regrette rien? An Empirical Test of Regret Theory and Stock Returns. Available at SSRN: http://dx.doi.org/10.2139/ ssrn.3786835

Bao, H. X. H. and Li, S. H. (2016). Overconfidence and Real Estate Research: A Survey of the Literature, *Singapore Economic Review*, 61(4), 1-24.

Barber, B. M. and Odean, T., (2000). Trading is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors, *Journal of Finance*, 55(2), 773-806.

Barber, B. M. and Odean, T. (2001). Boys will be Boys: Gender, Overconfidence, and Common Stock Investment, *Quarterly Journal of Economics*, 116(1), 261- 292.

Barber, B. M. and Odean, T. (2008). All that Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors, *Review of Financial Studies,* 21(2), 785-818.

Barberis, N. C. (2013). Thirty Years of Prospect Theory in Economics: A Review and Assessment, *Journal of Economic Perspectives*, 27 (1): 173-96.

Barberis, N. and Thaler, R. (2003). "A Survey of Behavioral Finance", In: G.M. Constantinides, M. Harris and R. M. Stulz (ed.), *Handbook of the Economics of Finance*, edition 1, volume 1, Chapter 18, 1053-1128.

Batmunkh, M.-U., Choijil, E., Vieito, J. P., Espinosa-Méndez, C. and Wong, W. K. (2020). Does Herding Behavior Exist in the Mongolian Stock Market, *Pacific-Basin Finance Journal,* 62, 101352,

Bell, D. E. (1982). Regret in Decision Making under Uncertainty, *Operations Research*, 30(5), 961-981.

Benos, A. V. (1998). Aggressiveness and Survival of Overconfident Traders, *Journal of Financial Markets*, 1, 353-383.

Bernard, D., Cade, N. and Connors, E. (2020). Are Managers Susceptible to the Ostrich Effect? Available at SSRN: https://ssrn.com/abstract=3752507.

Bianchi, M. and Tallon, J-M (2019). Ambiguity Preferences and Portfolio Choices: Evidence from the Field, *Management Science*, 65(4), 1486–1501.

Bikhchandani, S. and Sharma, S. (2001). Herd Behavior in Financial Markets, *IMF Staff Papers*, 47, 279–310.

Birru, J. (2015). Confusion of Confusions: A Test of the Disposition Effect and Momentum, *Review of Financial Studies*, 28(7), 1849–1873.

Bhattacharya, R. (2019). An Option Theoretic Approach to Market Efficiency. *Annals of Financial Economics*, 14 (4), 1-21

Cakan, E., Demirer, R., Gupta, R. and Uwilingiye, J. (2019). Economic Policy Uncertainty and Herding Behavior: Evidence from the South African Housing Market, *Advances in Decision Sciences*, 23(1), 88-113.

Chan, C.-Y., de Peretti, C., Qiao, Z. and Wong, W. K. (2012). Empirical Test of the Efficiency of the UK Covered Warrants Market: Stochastic Dominance and Likelihood Ratio Test Approach, *Journal of Empirical Finance*, 19(1), 162-174.

Chan, R. H., Clark, E., Guo, X. and Wong, W. K. (2020). New Development on the Third-Order Stochastic Dominance for Risk-Averse and Risk-Seeking Investors with Application in Risk Management, *Risk Management*, 22, 108-132.

Chang, H. H. (2020). "Application of Structural Equation Modeling in Behavioral Finance: A Study on the Disposition Effect", In: C. F. Lee and J. C. Lee (ed.), *Handbook of Financial Econometrics, Mathematics, Statistics, and Machine Learning*, Chapter 16, 603-626, World Scientific Publishing Co. Pte. Ltd.

Choe, H. and Eom, Y. (2009). The Disposition Effect and Investment Performance in the Futures Market, *Journal of Futures Markets*, 29(6), 496-522.

Choijil, E., Espinosa-Méndez, C., Wong, W.K., Vieito, J.P. and Batmunkh, M.U. (2022). Thirty Years of Herd Behavior in Financial Markets: A Bibliometric Analysis, *Research in International Business and Finance*, 59, 101506.

Clark, E.A., Qiao, Z. and Wong, W. K. (2016). Theories of Risk: Testing Investor Behaviour on the Taiwan Stock and Stock Index Futures Markets, *Economic Inquiry*, 54(2), 907-924.

Daniel, K., Hirshleifer, D. and Subrahmanyam A. (1998). Investor Psychology and Security Market Under- and Overreactions, *Journal of Finance,* 53(6), 1839-1885.

Daly, M., Harmon, C. P. and Delaney, L. (2009). Psychological and Biological Foundations of Time Preference, *Journal of the European Economic Association*, 7(2-3), 659–669.

De Bondt W. F. M. and Thaler R. (1985). Does the Stock Market Overreact? *Journal of Finance,* 40(3), 793-805.

Dimmock, S. G., Kouwenberg, R., Mitchell, O. S. and Peijnenburg, K. (2016). Ambiguity Aversion and Household Portfolio Choice Puzzles: Empirical Evidence. *Journal of Financial Economics*, 119(3), 559-577.

Dlugosch, D. and Wang, M. (2020). Ambiguity Aversion Can Lead to Lower Foreign Bias: New Empirical Evidence from an International Panel Study. Available at SSRN: https://ssrn.com/abstract=3675382.

Egozcue, M., Guo, X. and Wong, W. K., (2015). Optimal Output for the Regret-Averse Competitive Firm Under Price Uncertainty, *Eurasian Economic Review*, 5(2), 279-295.

Egozcue, M., Massoni, S., Wong, W. K. and Zitikis, R. (2014). Integration–Segregation Decisions under General Value Functions: Create your Own Bundle—Choose 1, 2, or All 3! *IMA Journal of Management Mathematics*, 25(1), 57-72.

Egozcue, M. and Wong, W. K. (2010). Segregation and Integration: A Study of the Behaviors of Investors with Extended Value Functions, *Journal of Applied Mathematics and Decision Sciences,* now *Advances in Decision Sciences 2010*, Article ID 302895, 1-8.

Einhorn H. J. and Hogarth R. M. (1986). Decision Making under Ambiguity, *Journal of Business,* 59(4), S225-S250.

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work, *Journal of Finance,* 25, 383–417.

Fama, E. F. (1998). Market Efficiency, Long-term Returns, and Behavioral Finance, *Journal of Financial Economics,* 49, 283-306.

Festinger L. and Carlsmith J.M. (1959), Cognitive Consequences of Forced Compliance, *Journal of Abnormal and Social Psychology*, 58, 203-210.

Fishburn, P. C. (1982). *The Foundations of Expected Utility*. Springer: Theory & Decision Library.

Fisher, I. (1928). *The Money Illusion*. New York: Adelphi.

Fogel, S. O. C. and Berry, T. (2006). The Disposition Effect and Individual Investor Decisions: The Roles of Regret and Counterfactual Alternatives, *Journal of Behavioral Finance*. 7(2), 107–116.

Fong, W. M., Wong, W. K. and Lean, H. H. (2005). International Momentum Strategies: A Stochastic Dominance Approach, *Journal of Financial Markets*, 8, 89-109.

Fuller, R. J. (1998). Behavioral Finance and Sources of Alpha, *Journal of Pension Plan Investing*, 2(3), 1-26.

Furnham, A. and Boo, H. C. (2011). A Literature Review of the Anchoring Effect, *Journal of Socio-Economics*, 40(1), 35-42.

Galai, D. and Sade, O. (2006). The "Ostrich Effect" and the Relationship between the Liquidity and the Yields of Financial Assets, *Journal of Business,* 79, 2741-2759.

Gasbarro, D., Wong, W. K. and Zumwalt, J. (2012). Stochastic Dominance and Behavior Towards Risk: The Market for iShares, *Annals of Financial Economics*, 7(1), 1-20.

Gervais S. and Odean T. (2001), Learning to be Overconfident, *Review of Financial Studies,* 14(1), 1-27.

Guidolin, M. and Rinaldi, F. (2013). Ambiguity in Asset Pricing and Portfolio Choice: A Review of the Literature, *Theory and Decision*, 74, 183–217.

Gul, Faruk (May 1991). A Theory of Disappointment Aversion. *Econometrica*, 59 (3), 667–86.

Guo, X., Egozcue, M. and Wong, W. K. (2021), Production Theory under Price Uncertainty for Firms with Disappointment Aversion, *International Journal of Production Research,* 59(8), 2392-2405.

Guo, X., Jiang, X. J. and Wong, W. K. (2017a), Stochastic Dominance and Omega Ratio: Measures to Examine Market Efficiency, Arbitrage Opportunity, and Anomaly, *Economies*, 5, no. 4: 38.

Guo, X., McAleer, M., Wong, W. K. and Zhu, L. X. (2017b). A Bayesian Approach to Excess Volatility, Short-term Underreaction and Long-term Overreaction During Financial Crises, *North American Journal of Economics and Finance*, 42, 346-358.

Guo, X. and Wong, W. K. (2016). Multivariate Stochastic Dominance for Risk Averters and Risk Seekers, *RAIRO – Operations Research,* 50(3), 575-586.

Guo, X. and Wong, W. K. (2019), Comparison of the Production Behaviour of Regret-averse and Purely Risk-averse Firms, *Estudios de Economía,* 46(2), 157-161.

Guo, X., Wong, W. K., Xu, Q. F. and Zhu, L. X. (2015). Production and Hedging Decisions under Regret Aversion, *Economic Modelling*, 51, 153-158.

He, Y., Chen, C. and Hu, Y. (2019). Managerial Overconfidence, Internal Financing, and Investment Efficiency: Evidence from China, *Research in International Business and Finance*, 47, 501-510.

Ho, P. H., Huang, C. W., Lin, C. Y. and Yen, J. F. (2016). CEO Overconfidence and Financial Crisis: Evidence from Bank Lending and Leverage, *Journal of Financial Economics*, 120(1), 194-209.

Hirshleifer, D. (2001). Investor Psychology and Asset Pricing, *Journal of Finance*, 56(4), 1533-1597.

Jarrow, R. (2012). The Third Fundamental Theorem of Asset Pricing, *Annals of Financial Economics,* 7(2), 1-11.

Jarrow, R. (2013). Option Pricing and Market Efficiency, *Journal of Portfolio Management*, 40(1), 88-94.

Jlassi, M., Naoui, K. and Mansour, W. (2014). Overconfidence Behavior and Dynamic Market Volatility: Evidence from International Data, *Procedia Economics and Finance*, 13, 128-142.

Kahneman, D. and Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk, *Econometrica,* 47(2), 263-292.

Karlsson N., Loewenstein G. and Seppi D. (2009). The Ostrich Effect: Selective Exposure to Information about Investments, *Journal of Risk and Uncertainty*, 38, 95-115.

Kaustia, M. (2010). *Disposition Effect*. In H. K. Baker and J. R. Nofsinger (eds.), Behavioral Finance (Robert W. Kolb Series in Finance). John Wiley & Sons.

Kudryavtsev, A. (2018). The Availability Heuristic and Reversals Following Large Stock Price Changes, *Journal of Behavioral Finance*, 19(2), 159-176.

Kudryavtsev, A. (2019). Short-Term Herding Effect on Market Index Returns, *Annals of Financial Economics*, 14(1), 1-16,

Kung, J. J. and Wong, W. K. (2009). Efficiency of the Taiwan Stock Market, *Japanese Economic Review,* 60(3), 389-394.

Kyle, A. S. and Wang, F. A. (1997). Speculation Duopoly with Agreement to Disagree: can overconfidence Survive the Market Test? *Journal of Finance*, 52(5), 2073-2090.

Lam K., Liu T. and Wong W. K. (2010). A Pseudo-Bayesian Model in Financial Decision Making with Implications to Market Volatility, Under- and Overreaction, *European Journal of Operational Research,* 203, 166-175.

Lam K., Liu T., and Wong W. K. (2012). A New Pseudo-Bayesian Model with Implications for Financial Anomalies and Investors' Behavior, *Journal of Behavioral Finance,* 13, 1-16.

Lean, H. H., McAleer, M. and Wong, W. K. (2010). Market Efficiency of Oil Spot and Futures: A Mean-variance and Stochastic Dominance Approach, *Energy Economics,* 32, 979-986.

Lee, K. (2017). Herd Behavior of the Overall Market: Evidence Based on the Cross-Sectional Comovement of Returns, *North American Journal of Economics and Finance*, 42I, 266-284.

Levy, H. and Orkan, M. (2012). Estimating Prospect Theory's Decision Weights with Stochastic Dominance: The Small Probability Case, *Annals of Financial Economics,* 7(2), 1-27.

Levy, M. and Levy, H. (2002). Prospect Theory: Much Ado About Nothing? *Management Science*, 48(10), 1334-1349.

Li, I-C. and Hung, J. H. (2013). The Moderating Effects of Family Control on the Relation between Managerial Overconfidence and Earnings Management, *Review of Pacific Basin Financial Markets and Policies*, 16(2), 1-33.

Li, C. K. and Wong, W. K. (1999). Extension of Stochastic Dominance Theory to Random Variables, *RAI–O - Operations Research,* 33(4), 509-524.

Li, K., Xia, B. and Guo, Z. (2021). A Consumption-based Asset Pricing Model with Disappointment Aversion and Uncertainty Shocks, *Economic Modelling*, 94, 235-243.

Lieder, F., Griffiths, T. L., Huys, Q. J. M. and Goodman, N. D. (2018). Empirical Evidence for Resource-Rational Anchoring and Adjustment, *Psychonomic Bulletin & Review*, 25, 775–784

Lim, S. S. (2006). Do Investors Integrate Losses and Segregate Gains? Mental Accounting and Investor Trading Decisions, *Journal of Business*, 79(5), 2539-2574.

Liu, Y. Y., Nacher, J. C., Ochiai, T., Martino, M. and Altshuler, Y. (2014). Prospect Theory for Online Financial Trading, *PLoS ONE*, 9(10), 1-7.

Liu, H., Wang, Y. and Zhang, L. (2021). The Herd Effect and Cross-Border Mergers and Acquisitions by Chinese Firms, *Emerging Markets, Finance and Trade,* DOI: 10.1080/1540496X.2021.1903866

Loomes, G. and Sugden, R. (1982). Regret Theory and Alternative Theory of Rational Choice under Uncertainty, *Economic Journal*, 92(368), 805-824.

Milkman, K. L. and Beshears, J. (2009). Mental Accounting and Small Windfalls: Evidence from an Online Grocer, *Journal of Economic Behavior and Organization*, 71 (2), 384-394,

Ng, P., Wong, W. K. and Xiao, Z. J. (2017), Stochastic Dominance via Quantile Regression with Applications to Investigate Arbitrage Opportunity and Market Efficiency, *European Journal of Operational Research,* 261(2), 666-678.

Noussair, C. N., Richter, G. and Tyran, J-R. (2012). Money Illusion and Nominal Inertia in Experimental Asset Markets, *Journal of Behavioral Finance*, 13(1), 27-37.

Odean, T. (1998). Are Investors Reluctant to Realize Their Loss? *Journal of Finance*, 53(5), 1775-1798.

Odean, T. (1999). Do Investors Trade Too Much? *American Economic Review*, 89(5), 1279-1298.

Patel, J., Zeckhauser, R. and Hendricks, D. (1991). The Rationality Struggle: Illustrations from Financial Markets, *American Economic Review,* 81(2), 232-236.

Qin, J. (2020). Regret-based Capital Asset Pricing Model, *Journal of Banking and Finance*, 114, 105784.

Ritter, J. R. (2003). Behavioral Finance, *Pacific-Basin Finance Journal,* 11(4), 492-437.

Seiler, M., Seiler, V., Traub, S. and Harrison, D. (2008). Regret Aversion and False Reference Points in Residential Real Estate, *Journal of Real Estate Research*, 30(4), 461-474.

Selim, K. S., Okasha, A. and Ezzat, H. M. (2015). Loss Aversion, Adaptive Beliefs, and Asset Pricing Dynamics, *Advances in Decision Sciences*, Article ID 971269, 18 pages.

Shefrin, H. and Statman, M. (1985). The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence, *Journal of Finance*. 40 (3), 777–790.

Shiller, R. J. (2001). Chapter 20 Human Behavior and the Efficiency of the Financial System, *Handbook of Macroeconomics*, 1, 1305-1304.

Shiller, R. J. (2003). From Efficient Markets Theory to Behavioral Finance, *Journal of Economic Perspectives*, 17(1), 83-104.

Simo, L., Nzongang, J. and Alvaréz-Otero, S. (2020). Cognitive Dissonance: An Evidence of How Self-protective Distortions Undermine IPO Decision. *Journal of Behavioural Economics, Finance, Entrepreneurship, Accounting and Transport*, 8(1), 7-13.

Statman, M., Thorley, S. and Vorkink, K. (2006). Investor Overconfidence and Trading Volume, *Review of Financial Studies*, 19(4), 1531–1565.

Sui, L, Sun, L. and Geyfman, V. (2021). An Assessment of the Effects of Mental Accounting on Overspending Behaviour: An Empirical Study, *International Journal of Consumer Studies*, 45(2), 221-234.

Tang, C. H., Lee, Y. H., Lee, M. C. and Huang, Y. L. (2020). CEO Characteristics Enhancing the Impact of CEO Overconfidence on Firm Value After Mergers and Acquisitions — A Case Study in China. *Review of Pacific Basin Financial Markets and Policies*, 23(1), 1-19.

Thaler, R. (1985) Mental Accounting and Consumer Choice, *Marketing Science*, 4, 199-214.

Thaler, R. H. (2015). *Misbehaving: The Making of Behavioral Economics*. New York: W. W. Norton & Company.

Thompson, H. E. and Wong, W. K. (1991). On the Unavoidability of "Unscientific" Judgement in Estimating the Cost of Capital, *Managerial and Decision Economics*, 12, 27-42.

Thompson, H. E. and Wong, W. K. (1996). Revisiting 'Dividend Yield Plus Growth' and Its Applicability, *Engineering Economist*, 41(2), 123-147.

Tiwari, A. K., Moslehpour, M., Pan, S. H. and Wong, W. K. (2021). Editorial in Honour of Professor Michael McAleer, *Advances in Decision Sciences*, forthcoming.

Tsang, C. K., Wong, W. K. and Horowitz, I. (2016). Arbitrage Opportunities, Efficiency, and the Role of Risk Preferences in the Hong Kong Property Market, *Studies in Economics and Finance*, 33(4), 735-754.

Tversky, A. and Kahneman, D. (1973). Availability: A Heuristic for Judging Frequency and Probability. *Cognitive Psychology*, 5 (2), 207–232.

Tversky, A. and Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases, *Science*, New Series, 185(4157), 1124-1131.

Tversky, A. and Kahneman, D. (1981). The Framing of Decisions and the Psychology of Choice, *Science*, 211(4481), 453-458.

Venezia, I. (2018). *Lecture Notes in Behavioral Finance*, World Scientific Lecture Notes in Finance: Volume 3, World Scientific Publishing Co. Pte. Ltd.

Vieito, J. P., Murthy, K. V. B. and Tripathi, V. (2013). Market Efficiency in G-20 Countries: The Paradox of Financial Crisis, *Annals of Financial Economics*, 8(1), 1-27.

Wong, W. K. (2006). Stochastic Dominance Theory for Location-Scale Family, *Journal of Applied Mathematics and Decision Sciences*, now *Advances in Decision Sciences*, 1-10.

Wong, W. K. (2007). Stochastic Dominance and Mean-Variance Measures of Profit and Loss for Business Planning and Investment, *European Journal of Operational Research*, 182(2), 829-843.

Wong, W. K. (2020). Review on Behavioral Economics and Behavioral Finance, *Studies in Economics and Finance,* 37(4), 625-672.

Wong, W. K. (2021). Editorial Statement and Research Ideas for Behavioral Financial Economics in Emerging Market, *International Journal of Emerging Markets*, 16(5), 946-951.

Wong, W. K. and Chan, R. (2004). On the Estimation of Cost of Capital and Its Reliability, *Quantitative Finance*, 4(3), 3–5 - 372.

Wong, W. K. and Chan, R. (2008). Prospect and Markowitz Stochastic Dominance, *Annals of Finance*, 4(1), 105-129.

Wong, W. K., Chow, S. C., Hon, T. Y. and Woo, K.Y. (2018). Empirical Study on Conservative and Representative Heuristics of Hong Kong Small Investors Adopting Momentum and Contrarian Trading Strategies, *International Journal of Revenue Management*, 10(2), 146-167.

Wong, W. K. and Li, C. K. (1999). A Note on Convex Stochastic Dominance, *Economics Letters,* 62, 293-300.

Wong, W. K. and Ma, C. (2008). Preferences over Location-Scale Family, *Economic Theory,* 37(1), 119-146.

Wong, W. K., Phoon, K. F. and Lean, H. H. (2008). Stochastic Dominance Analysis of Asian Hedge Funds, *Pacific-Basin Finance Journal*, 16(3), 204-223.

Woo, K. Y., Mai, C., McAleer, M. and Wong, W.K. (2020). Review on Efficiency and Anomalies in Stock Markets, *Economies*, 8(1), 20.

Xie, Y., Pantelous A. A. and Florackis, C. (2016). Disappointment Aversion and the Equity Premium Puzzle: New International Evidence, *European Journal of Finance*, 22(12), 1189-1203.

Yao, J., Ma C. and He, W. P. (2014). Investor Herding Behaviour of Chinese Stock Market. *International Review of Economics & Finance*, 29, 12-29.

Zhang, W. and Semmler, W. (2009). Prospect Theory for Stock Markets: Empirical evidence with Time-Series Data, *Journal of Economic Behavior and Organization*, 72 (3), 835-849.

Zhang, C. Y. and Sussman, A. B. (2018). Perspectives on Mental Accounting: An Exploration of Budgeting and Investing. *Financial Planning Review*, 1 (1–2)

Zhu, Z. Z., Bai, Z. D., Vieito, J. P. and Wong, W. K. (2019). The Impact of the Global Financial Crisis on the Efficiency of Latin American Stock Markets, *Estudios de Economía*, 46(1), 5-30.