

Behavioral mediators of financial decision making – a state-of-art literature review

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Abstract

Purpose – The purpose of this paper is to review the insights provided by behavioral finance studies conducted in the last decade (2006-2015) examining behavioral variables in financial decision making.

Design/methodology/approach – The literature review assesses 623 qualitative and quantitative studies published in various international refereed journals and identifies possible scope of future work.

Findings – The paper identifies stock market anomalies which contradict rational agents of modern portfolio theory at an aggregate level and behavioral mediators, influencing the financial decision making at an investor level. The paper also attempts to classify different dimensions of risk as professed by the investor.

Originality/value – The authors synthesize the contribution made by behavioral finance studies in extending the knowledge of financial market and investor behavior.

Keywords Behavioral mediators, Investor decision making, Risk dimensions, Stock market anomalies

Paper type Research paper

1. Introduction

All the concepts, theories and models of traditional and modern finance assume rationality of agents and efficiency of markets. However, latest researches in the domain of behavioral finance provide contradictory empirical evidence against these rational models. They examine the investor's rationality in the context of stock market anomalies at the aggregate level and investor's decision making on an individual level.

To put things in perspective, the traditional finance paradigm comprehends financial markets using models in which agents are rational. Researchers interpret rational agents on three dimensions. These have been represented in Figure 1. First dimension is investor's accessibility to the real-time dynamic information. Second is the investor's cognitive capability adjusting his working memory capacity and following Bayesian posterior probabilities. Third dimension is whether the investor has sufficient time for the evaluation of subjective utility of different possible alternatives.

These dimensions of the traditional finance theory have been much criticized in the literature as being simplistic and unpragmatic assumptions with low validity of its consequents. Behavioral finance researchers argue that an investor does not operate as a fully rational decision maker. Behavioral finance contradicts traditional finance on the premise of bounded rationality given by Herbert A. Simon (1955). Bounded rationality refers to the fact that human cognitive abilities are not infinite; instead, they have limited computational, conceptual skills and flawed memories. Behavioral finance uses models in which some agents are not fully rational, either because of preferences or because of mistaken beliefs (Ritter, 2003). Behavioral finance researchers discuss non-financial reasons influencing his rational paradigm and possibly explain his investment choices. Behavioral finance is a study of these non-financial behavioral reasons, the aggregate effect of which



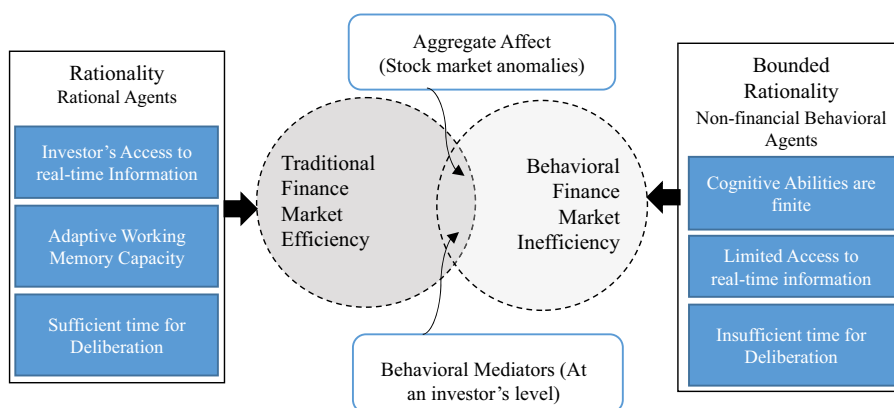


Figure 1.
Rationality vs
bounded rationality –
the psychological
mediation

results in mispricing of assets, overreaction, underreaction and other market anomalies. Figure 1 conceptualizes this interaction between behavioral foundations of decision making at an individual level and rational agents of traditional finance models resulting in aggregate market phenomena. Multiple researches have been conducted in this domain. Researchers have argued that there are several variables that affect the decision making which contradicts the traditional school of thought. The current paper has come out of an extensive literature review of various dimensions of behavioral finance that have been discussed over almost a decade.

For this purpose, a meta-analysis of research papers published in reputed international journals from 2006 to 2015 is conducted. The research paper has been organized in the subsequent sections as follows. Section 2 presents different journals reviewed and methodologies used. Section 3 presents contradictory evidence against rationality, i.e. stock market anomalies at an aggregate level followed by different behavioral mediators which affect investor decision making at an individual level. Section 5 presents classification of different dimensions of risk followed by research gaps and concluding remarks.

2. Classification of behavioral finance literature

2.1 Methodologies adopted

An exhaustive literature review is conducted by first identifying the refereed international journals where research papers on behavioral finance have been published from 2006 to 2015. Table I lists the journal wise research paper data base reviewed for the study. In total, 623 referred research papers published in the said journals were collated for study.

Table II lists methodology adopted by research papers. Mainly, conceptual, meta-analysis papers under qualitative techniques and mathematical modeling, secondary or primary data analysis, experimental investigations under quantitative techniques have been used.

3. Behavioral finance indicators at the aggregate level – does rationality exist?: contradictory evidence

The extant literature in the domain of behavioral finance provides empirical arguments which contradict the hypothesis that markets are efficient. These stock market anomalies are discussed under five sub-categories as aggregate market reaction or behavior, prediction anomalies, seasonality, response to events and others. Figure 2 lists the anomalies under these sub-categories.

Table I.
List of journals
reviewed

Name of the journal	Publisher	Number of research papers
1 <i>The Journal of Finance</i>	Wiley	62
2 <i>Review of Financial Studies</i>	Oxford University Press	63
3 <i>Journal of Financial Economics</i>	Elsevier	57
4 <i>Review of Behavioral Finance</i>	Emerald	36
5 <i>Journal of Behavioral Finance</i>	Taylor & Francis	214
6 <i>International Journal of Behavioral Accounting and Finance</i>	Inderscience Publishers	39
7 <i>Journal of Behavioral and Experimental Finance</i>	Elsevier	22
8 <i>Journal of Corporate Law Studies</i>	Taylor & Francis	2
9 <i>Journal of Financial Services Marketing</i>	Palgrave Macmillan	14
10 <i>European Journal of Social Sciences</i>	FRDN Incorporated	2
11 <i>Qualitative Research in Financial Markets</i>	Emerald	16
12 <i>European Financial Management</i>	Wiley	40
13 <i>Journal of Financial Stability</i>	Elsevier	18
14 <i>The European Journal of Finance</i>	Taylor & Francis	18
15 <i>Journal of International Financial Markets, Institutions & Money</i>	Elsevier	11
16 <i>Journal of Forecasting</i>	Wiley	9

3.1 Aggregate market reaction or behavior

3.1.1 Volume. Volume refers to the value of trades settled on any given day. Opposing buy-sell bids on the same stock reflects that investors have opposing price expectations of the security. Hence, volume defies rationality paradigm of investors. We argue that if all investors were rational, with same level of information and futuristic expectations, they would not place contrasting bids on the same security. Therefore, there would not be any trading activity in the stock exchange. However, owing to bounded rationality, all investors place differing bids owing to their own rational interpretations.

Volume, intra-day volume, abnormal increase/decrease in trading volume, volume of small trades have been analyzed in various papers with reference to changes in analyst recommendation and subsequent market signals (Juergens and Lindsey, 2009; Irvine *et al.*, 2007), corporate earnings announcements and investor attention (Kale *et al.*, 2009; Pevzner *et al.*, 2015), ex-dividend trading day behavior (Rantapuska, 2008), manipulation in stock prices on the last day of the quarter and subsequent reversal the following day (Ben-David *et al.*, 2013), and volume as a representative of information quality regarding future returns (Schneider, 2009; Hvidkjaer, 2008; Pan and Poteshman, 2006). Causal studies identify reasons for higher volume as unusually low or high pessimism in the market (Tetlock, 2007) and overconfidence, self-attribution bias (Chui *et al.*, 2010; Statman *et al.*, 2006).

3.1.2 Volatility. Volatility is the frequency and spread of fluctuation of the stock price. Higher the frequency and spread of fluctuations, higher will be the volatility. According to the traditional finance theory, intrinsic value of the security is a function of the future dividends and capital gains discounted in present value terms. The modern portfolio theory assumes markets to be informationally efficient with security absorbing and adjusting to new information (Fama, 1970). The theory also proposes that shares follow random walk (Fama, 1965). However, real-time share prices vary much more than it can be explained by these simplistic arguments: violating efficiency and rationality in stock markets (Shiller, 1981). Lewellen (2006) argues degree of leverage amplifies share volatility. Studies have used volatility as a proxy for macro-economic conditions (Apergis *et al.*, 2015) by evaluating the relationship between investor active investment and market volatility (Goddard *et al.*, 2015).

3.1.3 Market shocks, market inertia and bubbles. Various studies investigate market behavior after a market shock or a market bubble. Miralles-Marcelo *et al.* (2014) studied market

Year	Qualitative study		Conceptual	Meta-analysis	Event study	Experimental investigation	Mathematical modeling	Secondary data analysis	Primary data	Total
	Causal qualitative study	Qualitative study								
2006	2		6	2	1	4	10	14	3	40
2007	3		10	3	1	6	10	13	2	47
2008	6		8	3	1	8	7	15	4	52
2009	9		8	2	1	12	6	23	7	66
2010	2		7	2	2	8	5	16	8	50
2011	9		7	1	1	11	8	20	9	66
2012	8		6	4	2	9	12	16	10	67
2013	2		3	2	2	9	17	17	3	55
2014	9		15	2	4	18	21	34	2	105
2015	10		6	1	2	11	10	21	14	75
Total	60		76	17	17	96	106	189	62	623
Conceptual paper	These are subjective evaluation of behavioral determinants of investor decision making									
Meta-analysis paper	Includes comprehensive account of different but related researches in a select behavioral domain									
Causal qualitative study	These researches provide logical explanation to different stock market phenomenon by identifying behavioral drivers of investor decision making									
Event study	This gives an analytical account of pre- and post-market phenomenon with reference to a particular event under study									
Experimental investigation	The study involves identifying the causal relationships between antecedents and consequents by either controlling or initiating the behavioral variable under study									
Mathematical modeling	It includes papers that use mathematical modeling techniques like AHP, ANP and others and include specific numerical examples or models									
Secondary data	The research papers use price, volume and sensitivity data of share market and use mathematical tools to identify larger market phenomenon									
Primary data	The research papers present analysis of surveys									

Table II.
List of methodology used

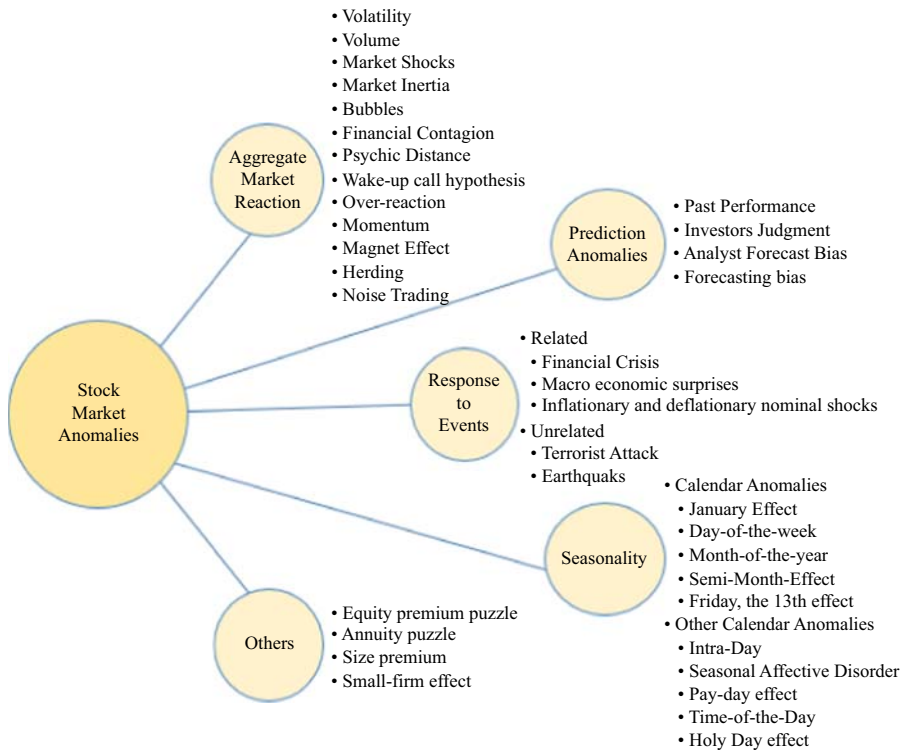


Figure 2.
Does rationality exist?:
Contradictory
evidence

reaction after positive and negative shocks. They report that positive shock or significant market overreaction is more important than negative shock in a bearish market with high degree of pessimism. Noussair *et al.* (2012) reports asymmetry in the price response to inflationary and deflationary nominal shocks wherein market exhibits considerable inertia and prices adjust slowly and incompletely toward fundamental levels after deflationary shock while Rapach *et al.* (2013) report lagged information diffusion of US shocks across other world economies. Messis and Zapranis (2014) report unexpected shocks on some macro-economic variables provide impetus to herding. Hong *et al.* (2012) hypothesize that arbitrageurs intensify the magnitude of economic shocks especially for highly shorted shares. Barrella *et al.* (2006) argue financial instability leads to lower consumption patterns, higher leverage and credit rationing.

Another set of studies comprehend behavioral drivers of market bubbles and bursts. Scherbina and Schlusche (2012) provide conceptual overview of asset bubble and bubble bursts in residential real estate markets citing optimistic views of unsophisticated households on the basis of past returns. Deck *et al.* (2014) argue entry of new generations with additional liquidity lead to asset bubbles and exit of old generations to bubble bursts. In an experimental investigation by Lahav (2011), subjects' backward induct or learning effect explains the cause of deviation from the fundamental value and multiple bubbles and crashes. Researchers also study the consequences of other shocks and bubbles like technological innovation and risk (Biais *et al.*, 2015; Kogan and Papanikolaou, 2013; DeMarzo *et al.*, 2007), technology bubble and fund manager experience (Greenwood and Nagel, 2009), patent shocks (Hsu, 2009), productivity shocks (Garleanu *et al.*, 2012; AI, 2010), shock to information quality (Savor, 2012; Illeditsch, 2011; Epstein and Schneider, 2008), liquidity shocks (Greenwood and Thesmar, 2011; Bali *et al.*, 2014), sentiment shocks (Mendel

and Shleifer, 2012), liquidity shocks (Arif and Lee, 2014), demographic shocks and decision about savings (Love, 2010).

3.1.4 Financial contagion, psychic distance, wake-up call hypothesis. Inter-connectedness of the trade between countries leads to inter-dependence of financial markets leading to financial contagion. Financial contagion is like a domino effect arising in one economy and spreading across multiple economies or stock markets. Haß *et al.* (2014) study mechanisms which trigger contagion, how one stock market influences another and the degree of co-movement in equity prices in large financial institutions (Hawkesby *et al.*, 2007). Zhu and Yang (2008) report psychic distance between the two countries as a driver of severity of contagion. Psychic distance is a behavioral dimension synthesizing geographic distance, common language, development level and common membership between the countries/ financial markets. The countries within close range of psychic distance exhibit stronger herding and contagion behavior. Studies on the wake-up call hypothesis suggest that wake-up call leads to contagion in other financial markets where the severity of the crisis is negatively related to the quality of economic fundamentals (Bekaert *et al.*, 2014) and markets focus more on country-specific characteristics. Further to this, Mobarek *et al.* (2016) observe that wake-up call differs among different country-pairs grouped on country-specific factors under crisis and non-crisis period. In another study, D'Ecclesia and Costantini (2006) have identified co-movements between major international stock markets. Fenzl and Pelzmann (2012) suggest investor's psychological dynamics in a complex market situation aggregates as a major market phenomenon like herding at the macro level. Pasquariello (2007) postulates heterogeneity of private fundamental information as a driver to financial contagion.

3.1.5 Overreaction or underreaction. Overreaction to any information is manifested as an abnormal change in the share price. A reaction is deemed to be an underreaction when the stock market reacts to the information even in subsequent time periods. Various studies have rationalized overreaction and identified behavioral constructs like overly optimistic forecasts (Hovakimian and Saenyasiri, 2014), soft or qualitative information in press releases (Cicon *et al.*, 2014), media accuracy (Ahern *et al.*, 2014), article tone in media publications (Hillert *et al.*, 2014), overconfidence (Durand, Newby, Peggs and Siekierka, 2013), personality traits (Durand, Newby, Tant and Trepongkaruna, 2013), disposition effect (Corzo *et al.*, 2014), representative and conservative heuristics (Lam *et al.*, 2012), market-wide attention grabbing media events (Yuan, 2015), or stocks (Barber and Odean, 2008) and managerial optimism in offer price (Shu *et al.*, 2012) as plausible drivers violating the informational efficiency hypothesis as proposed by modern theories. Hirshleifer *et al.* (2009) report investor inattention as a reason for market underreaction, while Giglio and Shue (2014) study market underreaction in absence of news or any other information.

3.1.6 Momentum. Momentum is continuation of reaction of a past event late into the future. Hence, stocks which generate higher and longer momentum appeal to the momentum traders. Muga and Santamaria (2007) studied results of new economy stocks, which owing to distinct characteristics generate higher momentum returns, increasing the concentration of momentum traders. Foerster (2011) evaluates the performance of momentum traders who buy stocks which have recently doubled in price in anticipation of further future gains and find that this strategy led to predictable disappointment. Malliaris and Bhar (2011) studied the role of momentum in equity premium puzzle across economic regimes using modeling and three-state Markov switching regime econometric methodology. On the behavioral end, role of disposition on momentum traders (Kubińska *et al.*, 2012) and, on the demographic end, cross-country cultural difference affecting momentum returns (Chui *et al.*, 2010) have also been studied.

3.1.7 Magnet effect. The magnet or gravitational effect is the pull exerted toward a stock price limits when trading halts are based on rules. The investors tend to enter into bids in advance which further pushes the prices toward the stock limits (Abadand Pascual, 2007). This investor and subsequent price behavior is presented as an anomaly to market rationality.

3.1.8 Herding and noise trading. Herding is a study of how micro-motives may cause macro-behavior. Considerable literature empirically substantiates the phenomenon of herding or inter-dependent trader behavior (Barber *et al.*, 2009; Prechter and Parker, 2007) citing diverse behavioral drivers like managerial intentions (Holmes *et al.*, 2013), changes in benchmark index composition leading to spurious herding (Walter and Weber, 2006), exogenous weak and strong information signals (Luchtenberg and Seiler, 2013), overconfidence (Corzo *et al.*, 2014), informative social influence resulting from heuristic or systematic information processing (Andersson *et al.*, 2014), forward falsely induced information cascade (Seiler, 2012), preference of group information over private (Seiler, 2012), revisions of analysts' recommendations away from prevailing consensus (Jegadeesh and Kim, 2010), unexpected shocks or asymmetric information (Hott, 2009) on some macro-economic variables leading to contagion (Messis and Zapranis, 2014), and herding toward risk factors (Messis and Zapranis, 2014). Fenzl and Pelzmann (2012) presented a review of herding and identified social influence, directedness, emulation and shift in risk perception as its drivers. Chen (2013) extends the work of earlier mathematical and empirical studies on herding among developed, emerging and frontier markets.

Noise trading refers to buying and selling in the market without using fundamental data. Antoniou *et al.* (2011) investigate presence of noise traders in futures market exhibiting long memory in positive feedback trading. Ramiah and Davidson (2007) validate the information-adjusted noise model assuming continuous information disclosure in the market. Foucault *et al.* (2011) identify retail investors as a proxy of noise traders effecting volatility of stock market, while Mendel and Shleifer (2012) model rational uninformed traders as noise chasers and thereby account for moving prices away from equilibrium (Bloomfield, Tayler and Zhou, 2009; Bloomfield, O'Hara and Saar, 2009). Kyle *et al.* (2011) correlate risk aversion of portfolio manager with price informative stating aversion decreases informativeness and vice-versa with the amount of noise trading.

3.2 Prediction anomalies

3.2.1 Past performance. A very popular investment strategy is extrapolating the share's past performance into future. This return-chasing behavior as a precursor to future performance is an important research dimension. Andreu *et al.* (2012) argue that purchases drive the prices and explain mutual fund performance instead of redemption requests. The sensitivity to fund's past performance is more pronounced when actual flows are considered instead of implied flows. While Sadka and Sadka (2009) argue that past prices are better predictors for the aggregate-level stock returns. Hong *et al.* (2007) studied market predictability as a function of industry past performance; Hüsser and Wirth (2014) relate investor's pursuit to past performance and their attention pattern with expected return. They argue that investors suffer from extrapolation bias which restricts rational decision making. Investors' expectations are influenced positively by under (or over) performance of the fund in the past (He and Shen, 2010). In an empirical study, Sharma and Mehra (2014) argue that a portfolio of stock near 52-week high point performs better than average even in bearish market. Daniel and Titman (2006) empirically dispute higher returns or book-to-market effect in companies with poor "distressed" past performance. In another interesting study, Alizadeh and Muradoglu (2014) study the information content of shipping freight in explaining share returns and using them as a proxy for economic returns.

3.2.2 Judgement errors – investors' judgment, analysts' forecasting bias. An investor or analyst's decision making is based on comprehension and analysis of information. The drivers and mediators of this cognitive process influencing financial forecasting remain an important research area in behavioral science. The errors in the judgment of information available are an anomaly which constraints rational decision making.

Shefrin (2015) presents correlational studies between investors' judgment of risk and fundamentals and actual returns. The results are consistent with the position that investors' judgments of risk and return, both mediated by sentiment, influence market prices. Studies identify many behavioral variables affecting investor judgment as investment-related knowledge and experience (Victoravich, 2010), financial professionals' overconfidence (Peterson *et al.*, 2015; Gloede and Menkhoff, 2014), decision goal (Young, 2009), social influence (Andersson *et al.*, 2014), analyst overoptimism (Jones and Johnstone, 2012), multiple information sources and subjective confidence (Du and McEnroe, 2011), affect (Sevdalis *et al.*, 2009), information spillovers (Hovakimian and Saenyasiri, 2014), unconditional size effect (Antoniou *et al.*, 2014), expected information quality (Kwag, 2014), analyst's evaluation of extent to disclosure reliability (McEwen *et al.*, 2008) and information on which analysts base their forecasts – trend, variability and recency (Ashton and Cianci, 2007).

Studies report that analysts' forecast bias has an influence over rational evaluation of the available market information. Excessive volatility in individual level forecasts also affects financial forecasting (Nursimulu and Bossaerts, 2014). Li and Wu (2014) use quantile regression to gauge the association between analysts' forecast dispersion and subsequent stock returns.

3.3 Response to events

3.3.1 Related events – financial crisis, macro-economic surprises, inflationary and deflationary nominal shocks. Events of extreme financial stress, financial crisis, macro-economic surprises and inflationary and deflationary shocks have been widely studied and analyzed. Researchers have tried to ascertain the reasons which led to these events and whether technical and fundamental analyses were able to predict it. Behavioral finance theorists rationalize these wide-spread financial meltdowns by integrating behavioral agents in rational models. One such behavioral determinant is the domination of unsophisticated households in residential real estate market (Scherbina and Schlusche, 2012). Another behavioral driver is the underestimation of risks by all stakeholders in the system (Muradoglu, 2010). Gilbert (2011) positively correlates revisions in macro-economic series with market reaction.

Another stream of inquiry has been the study of behavioral shift or crisis-induced changes in investors and their investment strategy post-facto events (Prorokowski, 2011). Bateman *et al.* (2011) argue that age and income mediate retirement saver investment choice and risk aversion after a financial crisis. Stock returns of winner and loser stocks show that winner stocks continue to gain and loser stock tumbles strongly after the crisis (Davis and Madura, 2012; Noussair *et al.*, 2012). Davis and Madura (2012) argue that investors move away from high-risk shares. This period is a proxy for low sentiments in the market (McLean and Zhao, 2014). Miralles-Marcelo *et al.* (2014) support these findings by providing evidence that positive shocks are better in a bearish market as they trigger overreaction. Messis and Zapranis (2014) empirically investigate that macro-economic shocks trigger strong herd behavior by investors, where institutional investors sell assets under short-trade investment horizons amplifying price pressure for retail investors (Cella *et al.*, 2013).

Gordon (2014) evaluates that institutional reforms only have a limited effect in such events of catastrophic financial consequences; however, Avgouleas (2009) argues on the scope of improvement in the statutory framework required by such financial crisis.

The study of Harju and Hussain (2011) suggests a high degree of the inter-connectedness of the US and European financial markets, and empirically found high volatility in European and subsequent markets after opening of the US markets. This inter-connectedness also translates in macro-economic surprises. In the same light, Messis and Zapranis (2014) argue on the benefits of international portfolio diversification.

3.3.2 *Unrelated events – terrorist attack and earthquake.* Another interesting stream of studies is centered on unrelated events and weightage of these events on stock prices and investor behavior. Bollerslev and Todorov (2011) modeled jump tail risk and measured investor fear index during rare events causing higher risk premium. Brounen and Derwall (2010) study the effect of terrorist attacks compared to earthquakes on stock markets across different nations. They report that prices revert back to the normal within one week of the day of the event. In another short-run correlational event study by Boisen *et al.* (2015), the effect of commencement of oil rig exploration till its completion and the subsequent changes in stock price is studied. Kliger and Kudryavtsev (2010) suggest a strong recency effect. This implies higher weightage to recent company-specific and event-specific information. Chen *et al.* (2012) analyzed how risk of rare economic disasters affects share price. Klomp (2014) studied extent and degree of a large-scale natural disaster on the solvency of commercial banks.

3.4 Seasonality

3.4.1 *Calendar anomalies.* Analyzed over a longitudinal time series, stock returns are seasonal. An inconclusive list of calendar anomalies studied over the last decade (2006-2015) is listed as under:

- January effect – average returns in the month of January are higher than other preceding and succeeding months. These higher returns are attributed to behavioral false hope syndrome (Anderson *et al.*, 2007; Ciccone, 2011) or tax-loss selling hypothesis (Starks *et al.*, 2006). The predictive power of January extends for the entire year (Cooper *et al.*, 2006) for few economies (Bohl and Salm, 2010).
- Day-of-the-week effect – mean stock returns are unusually higher on Fridays and lower on Mondays (Chaouachi and Douag, 2014).
- Month-of-the-year – this is similar to the January Effect. Also, few economies with different financial calendar exhibit different month of high mean returns (Chaouachi and Douag, 2014).
- Semi-month effect – mean stock returns of second half of the month are lower than mean stock returns of the first half (Chaouachi and Douag, 2014).
- Friday, the 13th effect – in a solitary research by Auer and Rottmann (2014), tetra-phobia, that is the fear of number four, is empirically validated for select Asian economies. Philippines reflect significant positive Friday the 13th effect, while South Korea has an inverse effect. Emerging Asian stock markets do not reflect Friday the 13th effect in a significant way.
- Intra-day effect – intra-day seasonality has been studied in the context of increased volatility of the European markets when the US markets open (Harju and Hussain, 2011).
- Seasonal affective disorder – this implies increased pessimism and risk aversion during fall and winter months, on stock analysts' earnings estimates (Dolvin *et al.*, 2009).
- Pay-day effect – increased trading exhibited by an employed trader on the last working day to increase one's compensation (Garvey and Wu, 2010).
- Time-of-the-day – risk-seeking behavior during different time of the day (trading session) has been studied in a gender split study (Oran and Akyatan, 2012).
- Holy day effect – increase in stock return during Muslim holy day has been studied and plausible drivers explored (Al-Ississ, 2015).

Heston and Sadka (2008) identified returns follow a pattern every year in the same calendar month and annual auto-correlation at a 12-, 24- and 36-month lag, lasting upto 20 annual lags.

3.5 Others

3.5.1 Equity premium puzzle, annuity puzzle. The premium or market return earned in equity is higher than any other asset class. Though equities fall under high risk-high return category, researchers reasoned that the return differential of 7 percent YoY is too high to be explained by risk alone. Theoretically, annuity investments yield much higher returns; however, empirical evidence suggests that market for annuity investment is much smaller. This dilemma or puzzle known as the annuity puzzle has been researched from a behavioral standpoint by Agnew *et al.* (2015). Different researchers have modeled equity premium to estimate its drivers and argue low quality of public information reason for high equity premium (AI, 2010), variation in risk aversion (Routledge and Zin, 2010), price of risk (Polk *et al.*, 2006), probability of poor consumption increasing equity premium (Wachter, 2013) and speculation on stock fundamental for risk averse investors explaining equity premium (David, 2008). However, Welch and Goyal (2008) study the models estimated for identifying the variables of equity premium puzzle and question their scalability, applicability and completeness.

3.5.2 Size premium, small-firm effect. Smaller firms are more volatile than larger firms and therefore earn higher returns. Another study by Guin (2005) reports that stocks with low prices tend to outperform the stocks with higher prices. Vijn and Yang (2013) argue that small firms are less vulnerable to overpriced stock offers. Small companies have a longer lag period of information diffusion (Hou, 2007), but a stronger effect of abnormal positive news by media (Gurun and Butler, 2012).

4. Behavioral finance mediators of investor decision making

This section describes various behavioral finance dimensions and their sub-criteria which influence investor decision making. Three dimensions which have been studied widely from 2006-2015 can be broadly classified as information, demographics and cognitive biases. Apart from these three dimensions, investor strategies and philosophy have also been researched from a behavioral standpoint.

4.1 Information

Accessibility, content, quality and reliability of information about the company is an important criterion which affects an investor decision. Evans and Lyons (2008) empirically investigated that macro-news accounts for more than 30 percent of daily stock price variations. Fernandes and Ferreira (2008) found that cross-listing leads to asymmetric price informativeness – with improvement in developed economies (Foucault and Gehrig, 2008) – and deterioration in emerging economies. Sources of information are corporate disclosures and media or institutional releases.

4.1.1 Corporate disclosures. Corporate disclosures include quarterly results, risk disclosures, corporate government disclosures, earnings announcements and others as per a legal and statutory framework. Further, corporate announcements like dividends, disposal announcement, IPO offer premium, earnings announcements, corporate governance improvements and their disclosure frequency also add to information sources. Studies assess the impact of these information signals on share price, volume, volatility (Zhang *et al.*, 2015) and investor risk perception (Walia and Kiran, 2012). Positive or favorable information reduces ambiguity in the stock market and increases share price. Higher disclosure frequency mitigates negative sentiment in the stock market (Pitre, 2007)

and positively correlates with post-issue performance management (Jo and Kim, 2007). Interplay between publically and privately held information in conjunction with media coverage and earnings announcement drift has been studied.

4.1.2 Media and institutional releases. Another important source of information is the media reports published in major business and national newspapers, channels and websites. Print, tele and web media is flooded with reports, press releases and stock recommendations by analysts providing recommendations with buy, hold or sell quotes, revising it regularly. Further, credit rating agencies release corporate financial analysis reports which are easily accessible on the agency's website. Other informal and invalidated sources of information are social micro-blogs and word-of-mouth communications. The quantum, quality and frequency of this information are dynamic; hence, it is not possible to comprehend real-time owing to Simon's bounded rationality paradigm. Researches in the last decade have studied the causal relationship between information, its sources, quality, frequency and stock investor's behavior at the micro level and market reaction at the macro level. Multiple qualitative researchers have identified media tone or media slant as an important factor in media coverage (Tetlock *et al.*, 2008; Gurun and Butler, 2012). Solomon *et al.* (2014) study media induced diversification in mutual fund industry where media coverage affects fund flows. Liden (2006) compare the price reaction difference between recommendations by analysts *vis-à-vis* journalists. Duong *et al.* (2014) report asymmetric response to positive and negative news for value and glamour stocks. Bystrom (2016) correlate media listings or news with volatility irrespective of the language of publication.

4.1.3 Ambiguity in information. Accuracy, relevance and clarity of information and reliability of information source affects importance or weightage of information in decision making. Arand *et al.* (2015) studied the informativeness of equity research with specific reference to sell-side analysts' reports. Information spill-over or information cascade has been studied with reference to imitating another investor's action believing he possesses superior information. Seiler (2012) argued that information cascade leads to herding. Small and Smith (2007) demonstrated empirically in an event study that owing to market inefficiencies information cascade can lead to higher share price. Luchtenberg and Seiler (2013) examined the effect of strength of the signal on the response it solicits in an experimental investigation. Illeditsch (2011) estimated that exogenous information disjoint of company's fundamentals triggers portfolio inertia at an investor level and excess volatility at the aggregate level. Other important drivers which lead to ambiguity in interpretation of information are information asymmetry, usage of red flag phrases and earnings environment ambiguity. Fratianni and Marchionne (2013) studied the diminishing impact of bank bailout news citing either inadequacy of bailout plan or incredibility of information.

4.2 Demographic factors

Multiple behavioral studies across various demographic factors have been conducted. In this section, we discuss demographic factors under four broad categories – socio-economic factors, socio-cultural factors, biological factors and demographic change (Figure 3).

4.2.1 Socio-economic factors. Age, wealth, financial literacy, family size, investor social status, investor habitat, location, size of the economy, survival rate, community participation in stock markets, industry affiliation, working experience, training and knowledge of an investor are some of the socio-economic factors studied. The researches have examined the role of these variables as either mediator or moderator in a causal relationship. Few linkages studied in the domain of behavioral finance are effects of age on risk taking (Sundali and Guerrero, 2009) with hump-shaped age profile of the distribution in risky assets (Brunetti and Torricelli, 2010), finance literacy on the social preferences and the

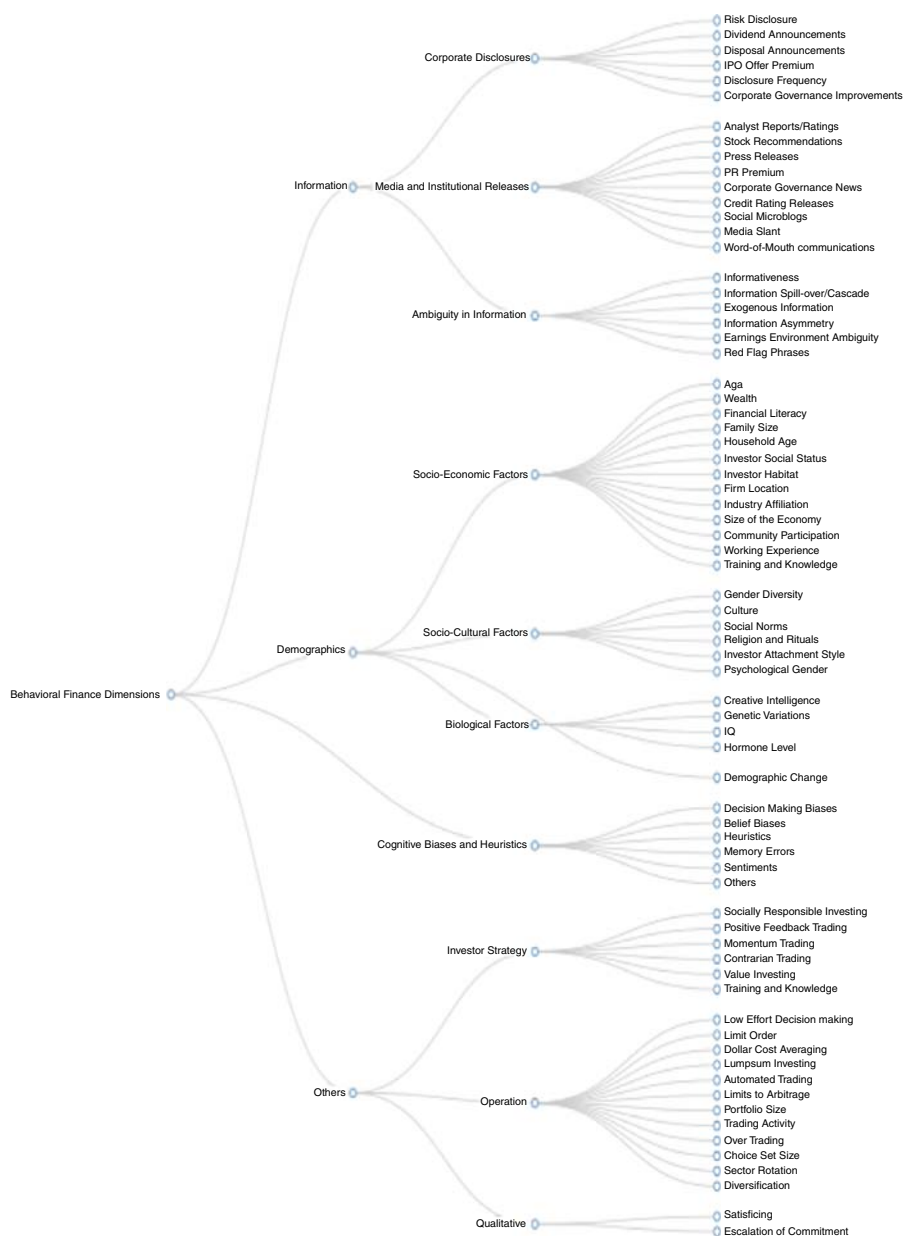


Figure 3.
Behavioral finance
dimensions

resultant investor behavior (McCannon, 2014), investor income level on overconfidence (Tekçe and Yılmaz, 2015), financial wealth and household age on stock diversification (Roche *et al.*, 2013), survival rate on ability to learn from trading experience (Seru *et al.*, 2010), age, experience, wealth on portfolio diversification (Nofsinger and Varma, 2014), family size on mutual fund investment (Gill *et al.*, 2011), investor status on investor's evaluation of information (Cianci, 2008), training, knowledge and experience on investor decision making

(Ackert *et al.*, 2010), difference in the size of economy on currency variations (Hassan, 2013), co-movement of firm prices same geographical areas (Pirinsky and Wang, 2006; Kedia and Rajgopal, 2009), role of firm location on information diffusion (Bernile *et al.*, 2015), agency cost and dividend policy (John *et al.*, 2011), preference to hold stock with average community participation in stock market (Brown *et al.*, 2008) and investor industry affiliation on expected stock returns (Eiling, 2013). In an interesting study, Kumar (2009) identified low-income investors to be trading high in lottery-type stocks and argued that players in lotteries and investors of lottery-type stocks exhibit similar socio-economic characteristics.

4.2.2 Socio-cultural factors. Socio-cultural factors like gender diversity, culture, religion and rituals, investor attachment style, psychological gender and social norms have been studied. The effect of gender diversity of a team (Bogan *et al.*, 2013) or board room composition (Hickman, 2014) on decision making – investment and operational – has been studied. Durand, Newby, Peggs and Siekierka (2013) and Durand, Newby, Tant and Trepongkaruna (2013) modeled investment choices as a function of personality, preference for innovation or risk taking propensity, psychological gender, and studied the effect of these variables in an experimental protocol. Correlational studies included role of culture, religion, ritual on investor faith in stock selection (Allen *et al.*, 2015), influence of culture and religion on trust (Abdussalam, 2014), role of corporate culture of firm behavior (Hillary and Hui, 2009), role of the prospect theory's reflection effect, a psychological factor, and uncertainty avoidance, a cultural factor (Mori *et al.*, 2010). Eun *et al.* (2015) argued that culture affects investor's trading activity and country-specific information. Hong and Kacperczyk (2009) empirically validated that social norm constrained institutions abstain from holding sin stocks – stocks of alcohol, tobacco and gaming companies.

4.2.3 Biological factors. Biological factors like hormone level, creative intelligence, IQ, genetic variations have been studied to interpret their behavioral reflections. Frydman *et al.* (2014) demonstrated that neural activity can be helpful to investigate investor behavior. In a solitary study, Oran and Akyatan (2012) studied the association between hormone levels and risk-taking behavior mediated by gender and time of the day. Cesarini *et al.* (2010) argue that some portion of variation in portfolio risk is explained by genetic variations. In a similar study, Cronqvist and Siegel (2014) argued that genetic differences expound 45 percent of behavioral variations and biases. In another research, Samet and Teulon (2012) examined the benefits of creative intelligence as a function of company's R&D investment, patents, intellectual property rights on stock markets. IQ improves diversification and stock market participation (Grinblatt *et al.*, 2011), where high IQ investors are less affected by the disposition effect (Grinblatt *et al.*, 2012).

4.2.4 Demographic change. Previous researches have studied quantitative demographic variables like age, income, wealth and their associations with the behavioral criterion variable. Ammann *et al.* (2011) examined the effect of change in age group sizes as a predictor of demand of pharmaceutical drugs. This study extended the hypothesis that investors overreact to recent information and are unmindful with extrapolation.

4.3 Cognitive biases and heuristics

Cognitive biases and heuristics are an important research mediator and moderator for investor decision making. This section briefly outlines important biases studied in the last decade under six broad categories – decision-making biases, belief biases, heuristics, memory errors, sentiments and others (refer Figure 4).

4.3.1 Decision-making biases. Decision-making biases affect investor behavior and decisions due to repeated occurrence of a specific set of condition. The decision-making biases discussed in the literature are overconfidence, proximity preference, dual mental



Figure 4.
Classification of
cognitive biases and
heuristics

accounting model, status quo bias, conjunction fallacy, endowment effect, house money effect, optimism/pessimism, wishful thinking.

4.3.2 Belief biases. Belief biases are the set of prejudices which affect materialization and realization of an investor belief. Some of the belief biases studied in the last decade include self-attribution biases, better-than-average belief, belief about deception, projection bias, ego-centric bias, attribution bias, affective self-affinity, self-deception.

4.3.3 Heuristics. Heuristics is a rule of thumb or guide in the investigation, usually evolved with experience in the related field, guaranteeing immediate sufficient solution to the problem at hand. Stock market investors resort to set of heuristics owing to limits of optimization, rationality and time. Some of the heuristics studied are affective heuristic, availability, representativeness, conservative, 1/N heuristic, trading heuristic.

4.3.4 Memory errors. A memory error or bias is a moderator which either limits or boosts memory recall in terms of content, time and consistency of reported memory. Few of the memory errors studied are omission bias, perceived loss index, assimilation effect.

4.3.5 Sentiments. Sentiments are physical manifestation of interaction and assimilation of five material senses associating them with or as something considered transcendental: feelings and emotions. Various sentiments studied in behavioral finance literature include mood, trust, saliency, xenophobia, anxiety, stress, fear, regret, doubt, sensation seeking, affect, emotional arousal to losses, impulsivity, emotional intelligence, sentiment indicator.

4.3.6 Others. Apart from the cognitive biases and heuristics listed above, there have been other biases and sentiments which have also been studied with reference to investor

decision making. A partial list of these are home-bias, myopic loss aversion, regret aversion, certainty effect, fear of unknown, uncertainty avoidance, optical bias, hedonic editing hypothesis, pygmalion, contrast effect, company affect, equity home bias.

4.4 Investor strategies

This section discusses investor trading strategies integrating the effect of behavioral variables. The literature reports diverse investor strategies, the importance of these strategies for companies, the market reaction they generate, factors influencing decision processing at the cognitive frame, significance at an investor frames' level, among others. In this section, we present review of investor philosophies, operational strategies and qualitative objectives which are responsible for an investor decision making.

4.4.1 Investor philosophy. Glac (2012) examined individual and environmental factors affecting mental frames and the subsequent role and interaction of these investment frames and investor expectations prior to social responsible investing. Rubaltelli *et al.* (2010) demonstrated a positive influence of socially responsible fund on its market price on an investor frame. These studies highlight the importance of corporate government disclosures which a company publishes periodically.

Another trading strategy is positive feedback trading. Here, an investor follows the current sentiment and cues of the market. Positive feedback is the reason why declining market further declines and boom leads to next higher boom. Studies suggest positive feedback trading as a key driver for market volatility. Noise traders demonstrate long memory pattern in futures market following positive feedback trading (Antoniou *et al.*, 2014). Koutmos (2014) presented comprehensive literature review highlighting the work done so far, gaps and scope of future work.

The next strategy studied by researchers is the momentum and contrarian strategy. Momentum traders invest in stocks which have witnessed recent increase or decrease in prices. Accordingly, they take short or long positive in the market as per the prevailing trend. Contrarian investors provide opposing force in the market by placing long bids on losing stocks and short bids of gaining stocks. Their strategy is contrary to the prevailing market trend. Galariotis (2014) presented comprehensive review of the literature on momentum and contrarian trading. Foerster (2011) examined empirically simple heuristic followed by momentum traders to buy stocks which have doubled in the past in anticipation of the trend to prevail. Kubińska *et al.* (2012) argued that contrarian traders are more prone to the disposition effect than momentum traders.

In an interesting study, Otuteye and Siddiquee (2015) proposed a simple heuristic for investment decision making based on absolute company fundamentals. This procedure will not only enable financial decision making but will also contain the effect of cognitive biases.

4.4.2 Operational details. Short-term trading heuristics or strategies followed by investors, which mainly focus on operational procedures and protocols, are discussed here.

Investors operationalize their bids by using limit orders which limit the extent of losses in the sell or buy bid. A buy limit order is executed at the limit price or lower, and a sell limit order is executed at the limit price of higher. In a market with asymmetrically informed traders, insiders maximize their returns using limit orders, uninformed traders earn only market return and average informed traders lose with market orders and more with limit orders (Stöckl and Kirchler 2014).

Other operational strategies include modeling portfolio performance where portfolio explains cross-sectional variation (Anderson, 2007), estimating stability and statistical control of automated trading platforms (Kumiega and Van Vliet 2012), evaluating behavioral perspective of an investor trading activity – biases, personality traits, overconfidence and risk tolerance (Kourtidis *et al.*, 2011), assessment of trading activity of

OTC investors compared to penny stock investors (Nofsinger and Varma, 2014), identifying firms with lower leverage (Muradoğlu and Sivaprasad, 2012). Lee *et al.* (2013) reported the choice of retirement fund as a low-effort decision where most of the investors invest in conservative schemes only. Investors are classified as following lump-sum investing, that is, investing the entire amount as a consolidated investment, or dollar cost averaging, that is, investing equal installments periodically. Dichtl and Drobetz (2011) rationalized dollar cost averaging to be consistent with behavioral finance paradigm offering flexibility to shift portfolio immediately. Scherbina and Schlusche (2012) argued that the returns in real estate market are range-bound with limits to arbitrage returns.

Cervellati *et al.* (2011) evaluated the role of gender, status, income and other individual characteristics on number of trades an investor places to estimate investor's attitude toward risk and overconfidence. Kida *et al.* (2010) gauged the role of choice-set size and decision outcome consistent with the notion of cognitive constraint of bounded rationality. Beber *et al.* (2011) showed that portfolio rebalancing is consistent with sector rotation across different business cycles. Fuertes *et al.* (2014) cited positive correlational effects of wealth, income and education on portfolio diversification, while large volume transactions, married professionals have poorer portfolio diversification possibly due to overconfidence.

Researches have also studied benefits of diversification, degree of diversification, naïve diversification, modeled home-made diversification and diversification myth.

4.4.3 Qualitative. Satisficing is an investor strategy where subjective adequacy is sought to give a satisfactory outcome instead of the best possible one. Its intuitive appeal is consistent with the cognitive dimension of bounded rationality (Simon, 1955). Güth *et al.* (2008) experimentally estimated behavioral repercussions or choice changes of satisficing especially after investor becomes aware of it. Another subjective evaluation was conducted by Lin, Massa and Zhang (2014) and Lin, Fan and Chih (2014) of escalation of commitment of losing stocks by mutual fund managers in an event of misjudged stock return.

5. Classification of risk and its dimensions

An extensive review of literature indicates that behavioral variables discussed in previous sections effect risk and its varied dimensions which subsequently affect investor decisions. This section discusses these risk dimensions.

5.1 Risk perception

Risk perception is the subjective assessment an investor makes about the characteristics and severity of risk. The judgement includes understanding of the investment product, familiarity, prevalence or frequency of occurrence, possible of risk of capital loss, possible risk of lower-than expectations, variation range and chance of higher-than-inflation returns. Risk perception in investment decision making is the qualitative judgment that people make about the character of risk with a view of possible magnitude or expected returns, their extent and timing and severity. Risk perception has two partitions – inherent risk (latent risk which a product class holds for consumers. This is high for stock markets and even higher for few products in stock market). Handled risk includes the effect of information and risk reduction processes which cognitive brain does even before we voice it. This is basically the amount of conflict which a product class stimulates after receiving information about the same.

5.2 Risk premium

In a capital asset pricing model, risk premium has been defined as a compensation for a risk tolerant investor of addition return expected by an investor as a reward for additional risk booked. Studies has tried to ascertain the association of equity risk premium and optimism/pessimism or expected cost of equity.

5.3 Risk neutral

A risk-neutral investor is indifferent about the underlying asset's risk and is only concerned about the return from the investment. A risk-neutral measure is an equilibrium measure such that theoretical price of discounted future returns is equal to share price.

5.4 Risk tolerance

Risk tolerance or threshold is a person's emotional comfort with financial risk – how psychologically receptive an individual is to situations involving financial risk. It is a composite of risk attitude and risk capacity. Risk capacity is a financial attribute and refers to how much risk an investor can afford to take. Risk attitude is a psychological attribute and means how much risk an investor decides to take. Risk profile is a qualitative assessment of an investor's risk appetite and preference.

5.5 Risk aversion

Risk aversion is the subjective tendency to avoid uncertainty in expected returns.

5.6 Risk taking/risk-taking propensity/risk seeking/willingness to take risk/risk proneness/risk preferences

Risk taking is the subjective tendency to accept risk in anticipation of expected returns. The phrases have been used interchangeably in the literature.

5.7 Risk judgment/risk measure

Risk judgment is the subjective evaluation or assessment of the risk in an investment. This is subjective as every investor can have a different evaluation of risk based according to his bounded rationality.

5.8 Riskiness/risk level

Riskiness refers to an investment which involves risk. Risk level provides a scale for relative analysis between comparable investments.

Figure 5 provides a comprehensive review of the research in the mentioned broad risk dimensions followed by the list of authors classified year-wise and dimension-wise.

Risk perception/psychometric risk perception:

2008-2009	Levy and Benita (2009), Vlaev <i>et al.</i> (2009), Sevдалис <i>et al.</i> (2009), Sundali and Guerrero (2009), Sjöberg and Engelberg (2009)
2010-2011	He and Hu (2010), Feldman (2010), Belcher (2010), Singh and Bhowal (2010), Aspara and Tikkanen (2010), Wang <i>et al.</i> (2011), Wang <i>et al.</i> (2011)
2012-2013	Mueller and Brettel (2012), Aspara (2013), Olsen (2012a, b), Mishra and Kumar (2012), Mueller and Brettel (2012), Walia and Kiran (2012), Fenzl and Pelzmann (2012)
2014-2015	Garvey and Wu (2015), Hoffmann <i>et al.</i> (2015), Du and Shelley (2014)

Risk premium:

2006-2007	Lawrence <i>et al.</i> (2007), Basak <i>et al.</i> (2007)
2008-2009	David (2008), Malloy <i>et al.</i> (2009), Easley and O'Hara (2009), Dolvin <i>et al.</i> (2009), Semenov (2009), Roger (2009), McManus <i>et al.</i> (2009)

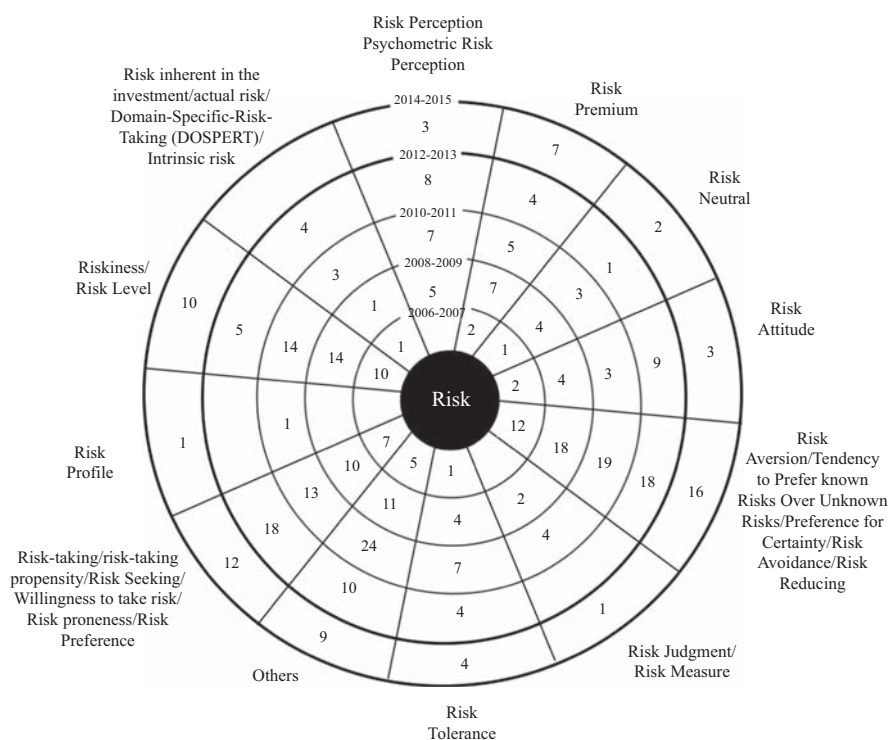


Figure 5.
Classification of risk
and its dimensions

2010-2011 He and Shen (2010), Bateman *et al.* (2011), Dichtl and Drobetz (2011), Gregory (2011), Bollerslev and Todorov (2011)
 2012-2013 Olsen (2012a, b), Xu (2012), Kogan and Papanikolaou (2013), Fong (2013)
 2014-2015 Prosad *et al.* (2015a, b), Johnk and Soydemir (2015), Viebig (2015), Kwag (2014), Andrei and Hasler (2015)

Risk neutral:

2006-2007 Pasquariello (2007)
 2008-2009 Gth *et al.* (2008), Han (2008), Roger (2009), Fellner (2009)
 2010-2011 Bateman *et al.* (2011), Li *et al.* (2011), Bollerslev and Todorov (2011)
 2012-2013 Ilomki (2012)
 2014-2015 Paul *et al.* (2015), Foster and Warren (2015)

Risk attitude:

2006-2007 Kim and Nofsinger (2007), Cheng (2007)
 2008-2009 Vlaev *et al.* (2008), Levy and Benita (2009), Sjöberg and Engelberg (2009), Fellner (2009)
 2010-2011 Kliger and Kudryavtsev (2010), Wang *et al.* (2011), Kliger and Tsur (2011)

2012-2013 Lee *et al.* (2013), Chen and Lai (2013), Fong (2013), Markiewicz and Weber (2013), Xu (2012), Rieger (2012), Walia and Kiran (2012), Hibbert *et al.* (2012a, b)
2014-2015 Talpseppa *et al.* (2014), Paul *et al.* (2015)

Risk aversion/tendency to prefer known risks over unknown risks/preference for certainty/
risk avoidance/risk reducing/risk prevention:

2006-2007 Okuyama and Francis (2006), Lewellen (2006), Allen *et al.* (2006), DeMarzo *et al.* (2007), Ziegler (2007), Peterson (2007), Lawrence *et al.* (2007), Sevdalis and Harvey (2007), Peterson (2007), Ammann and Verhofen (2007), Olson (2006), Uchida (2006)
2008-2009 Parnes (2008), Vlaev *et al.* (2008), Grou and Tabak (2008), David (2008), Chabi-Yo *et al.* (2008), Malloy *et al.* (2009), Hillary and Hui (2009), Easley and O'Hara (2009), Mulino *et al.* (2009), Du (2009), Dolvin *et al.* (2009), Peltomäki (2009), Semenov (2009), Levy and Benita (2009), Roger (2009), Vlaev *et al.* (2009), Fellner (2009), Roszkowski and Cordell (2009)
2010-2011 Belcher (2010), Ackert *et al.* (2010), Seiler and Seiler (2010), Jadlow and Mowen (2010), Mori *et al.* (2010), Cheng (2010), Mori *et al.* (2010), Roussanov (2010), Routledge and Zin (2010), Dorn and Huberman (2010), Kyle *et al.* (2011), Talpsepp (2011), Bateman *et al.* (2011), Roger (2011), Loibl and Hira (2011), Li *et al.* (2011), Hens and Vlcek (2011), Kliger and Tsur (2011), Dichtl and Drobetz (2011)
2012-2013 Anagol and Gamble (2013), Chen and Lai (2013), Fong (2013), Lai *et al.* (2013), Andreu *et al.* (2012), Ilomäki (2012), Hibbert *et al.* (2012a, b), Xu (2012), Mueller and Brettel (2012), Kubińska *et al.* (2012), Davis and Madura (2012), Rieger (2012), Seiler *et al.* (2012), Kumiega and Van Vliet (2012), Fenzl and Pelzmann (2012), Hoffmann and Fischer (2012), Bogan *et al.* (2013), Andersson *et al.* (2013)
2014-2015 Teixeira *et al.* (2015), Kronborg and Jarner (2015), Agnew *et al.* (2015), Viebig (2015), Paul *et al.* (2015), Foster and Warren (2015), Garvey and Wu (2015), Hoffmann *et al.* (2015), Uhl (2014), Luchtenberg and Seiler (2014), Kwag (2014), Kadous *et al.* (2014), Beilis *et al.* (2014), Nursimulu and Bossaerts (2014), Ahern and Sosyura (2015), Biais *et al.* (2015)

Risk judgment/risk measure:

2008-2009 Du (2009), Masood *et al.* (2009)
2010-2011 Cheng (2010), Wang *et al.* (2011), Belcher (2010), Ackert *et al.* (2010)
2014-2015 Shefrin (2015)

Risk tolerance:

2006-2007 Uchida (2006)
2008-2009 Wang (2009), Sundali and Guerrero (2009), Durand *et al.* (2008), Parnes (2008)

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- 2010-2011 Corter (2011), Kourtidis *et al.* (2011), Loibl and Hira (2011), Bateman *et al.* (2011), Belcher (2010), Ackert *et al.* (2010)
- 2012-2013 Hibbert *et al.* (2012a, b), Xu (2012), Davis and Madura (2012), Hibbert *et al.* (2012a, b)
- 2014-2015 Agnew *et al.* (2015), Dobni and Racine (2015), Foster and Warren (2015), Hoffmann *et al.* (2015), Cudd *et al.* (2014)
-

Risk taking/risk-taking propensity/risk seeking/willingness to take risk/risk proneness:

- 2006-2007 Cheng (2007), Peterson (2007), Prechter Jr and Parker (2007), Ammann and Verhofen (2007), Okuyama and Francis (2006), Basak *et al.* (2007)
- 2008-2009 Du (2009), Wang (2009), Levy and Benita (2009), Speidell (2009), Vlaev *et al.* (2009), Sevdalis *et al.* (2009), Sundali and Guerrero (2009), Sjöberg and Engelberg (2009), Durand *et al.* (2008), Vlaev *et al.* (2008)
- 2010-2011 Talpsepp (2011), Bateman *et al.* (2011), Routledge and Zin (2010), Loibl and Hira (2011), Hens and Vlcek (2011), Wang *et al.* (2011), Kliger and Tsur (2011), Dichtl and Drobetz (2011), Belcher (2010), Seiler and Seiler (2010), Jadow and Mowen (2010), Mori *et al.* (2010), Garvey and Wu (2010)
- 2012-2013 Lai *et al.* (2013), Oran and Akyatan (2012), Kubińska *et al.* (2012), Durand, Newby, Peggs and Siekierka (2013), Durand, Newby, Tant and Trepongkaruna (2013), Andersson *et al.* (2013), Anagol and Gamble (2013), Jeffrey and Putman (2013), Hu and McNish (2013), Durand, Newby, Peggs and Siekierka (2013), Chen and Lai (2013), Fong (2013), Markiewicz and Weber (2013), Bassi *et al.* (2013), Kubińska *et al.* (2012), Davis and Madura (2012), Hibbert *et al.* (2012a, b), Fenzl and Pelzmann (2012), Hoffmann and Fischer (2012)
- 2014-2015 Andersona *et al.* (2015), Agnew *et al.* (2015), Dobni and Racine (2015), Paul *et al.* (2015), Hoffmann *et al.* (2015), Luchtenberg and Seiler (2014), Kwag (2014), Kadous *et al.* (2014), Beilis *et al.* (2014), Cheng (2014), Cudd *et al.* (2014)
-

Risk profile:

- 2010-2011 Bateman *et al.* (2011)
- 2014-2015 Dobni and Racine (2015)
-

Riskiness/risk level:

- 2006-2007 Kim and Nofsinger (2007), Lawrence *et al.* (2007), Sevdalis and Harvey (2007), Cheng (2007), Prechter Jr and Parker (2007), Ammann and Verhofen (2007), Polk *et al.* (2006), DeMarzo *et al.* (2007), Rasmusen (2007).
- 2008-2009 Du (2009), Dolvin *et al.* (2009), Peltomäki (2009), Levy and Benita (2009), Roger (2009), Vlaev *et al.* (2009), Sundali and Guerrero (2009), Speidell (2009), David (2008), Fang and Peress (2009), Vlaev *et al.* (2008), Güth *et al.* (2008), Grou and Tabak (2008), Butler (2008)

RBF 10,1	2010-2011	Livanas (2011), Aspara and Tikkanen (2011), Loughran and McDonald (2011), Kliger and Tsur (2011), Kaplanski and Levy (2010), Grinblatt <i>et al.</i> (2011), Illeditsch (2011), Beber <i>et al.</i> (2011), Agrawal and Borgman (2010), Feldman (2010), Aspara and Tikkanen (2010), Garvey and Wu (2010), Kliger and Kudryavtsev (2010)
	2012-2013 2014-2015	Rieger (2012), Hoffmann and Fischer (2012), Mendel and Shleifer (2012) Kempf <i>et al.</i> (2014), Kamoto (2014), Prosad <i>et al.</i> (2015a, b), Otuteye and Siddiquee (2015), Pellinen <i>et al.</i> (2015), Messis and Zapranis (2014), Bali <i>et al.</i> (2014), Giglio and Shue (2014)

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Risk inherent in the investment/actual risk/domain-specific risk taking/intrinsic risk:

2006-2007	Brown and Kapadia (2007)
2008-2009	Vlaev <i>et al.</i> (2009)
2010-2011	Bateman <i>et al.</i> (2011), Feldman (2010), Aspara and Tikkanen (2010)
2012-2013	Markiewicz and Weber (2013), Lai <i>et al.</i> (2013), Fenzl and Pelzmann (2012), Davis and Madura (2012)

Others:

2006-2007	Okuyama and Francis (2006), Okuyama and Francis (2007), Cheng (2007), Basak <i>et al.</i> (2007), Rasmusen (2007)
2008-2009	Doukas and Li (2009), Peltomäki (2009), Durand <i>et al.</i> (2008), Vlaev <i>et al.</i> (2008), Vlaev <i>et al.</i> (2009), Semenov (2009), Malloy <i>et al.</i> (2009), Hong and Kacperczyk (2009), Avramov <i>et al.</i> (2009), Hillary and Hui (2009)
2010-2011	Belcher (2010), Wang <i>et al.</i> (2011), Agrawal and Borgman (2010), Feldman (2010), Seiler and Seiler (2010), Jadow and Mowen (2010), Aspara and Tikkanen (2010), Aspara and Tikkanen (2011), Kliger and Tsur (2011), Dichtl and Drobetz (2011), Magnuson (2011), Bateman <i>et al.</i> (2011), Wang <i>et al.</i> (2011), Kliger and Kudryavtsev (2010), Cesarini <i>et al.</i> (2010), AI (2010), Roussanov (2010), Dorn and Huberman (2010), Greenwood and Thesmar (2011), Rooij <i>et al.</i> (2011), Korniotis and Kumar (2011)
2012-2013	Fenzl and Pelzmann (2012), Davis and Madura (2012), Shu <i>et al.</i> (2012), Olsen (2012a, b), Mueller and Brettel (2012), Fong (2013), Kim <i>et al.</i> (2012), Chen <i>et al.</i> (2012), Eiling (2013)
2014-2015	Nursimulu and Bossaerts (2014), Sturm (2014), Viebig (2015), Paul <i>et al.</i> (2015), Hüsser (2015), So and Wang (2014), Pettenuzzo <i>et al.</i> (2014)

The list of dimensions which fall under the category others have been listed under Table III.

6. Concluding remarks

This paper gives insight into existing studies on behavioral finance during the last decade (2006-2015). It identifies aggregate stock market anomalies which contradict rational agents of modern portfolio theory in the first section. Further, the behavioral mediators influencing

Arbitrage risk	Doukas and Li (2009)	Risk borne by value (high book-to-market value) stocks due to increased preference to glamour stocks (low book-to-market value) in an arbitrage operation
Idiosyncratic risk	Roussanov (2010), Wang <i>et al.</i> (2011), Mueller and Brettel (2012), Fong (2013), Eiling (2013), Sturm (2014)	Residual or risk specific to a particular segment. This can be diversified
Risk belief	Olsen (2012a, b)	Risk belief refers to the trust an investor has pertaining to risk perception about an investment. This is a composite of attributes as perceptual control, variation or range of expected returns, probability of capital loss
Risk exposure	Okuyama and Francis (2006), Okuyama and Francis (2007), Hillary and Hui (2009), Peltomäki (2009), Viebig (2015)	Quantified negative return potential of an investment. It is a function of the probability of risk and amount of possible loss
Risk appetite	Fong (2013), Paul <i>et al.</i> (2015)	Willingness of an investor to bear a particular risk
Return-risk profiles	Durand <i>et al.</i> (2008), Vlaev <i>et al.</i> (2008), Agrawal and Borgman (2010), Feldman (2010), Seiler and Seiler (2010), Jadlow and Mowen (2010), Aspara and Tikkanen (2010, 2011), Kliger and Tsur (2011), Dichtl and Drobetz (2011), Magnuson (2011)	Risk-return profile of an asset class is backed by the principle that an investor will assume additional risk only when rewarded by addition return referred to as risk premium
Prediction risk/risk of lower-than-expectation return	Nursimulu and Bossaerts (2014), Wang <i>et al.</i> (2011)	Risk associated with the subjective judgment regarding prediction of future events
Distress risk	Davis and Madura (2012), Shu <i>et al.</i> (2012), Fong (2013)	Risk arising out of financial distress and instability in the economy or specific to a company
Risk associated with information asymmetry	Shu <i>et al.</i> (2012)	Risk associated with incomplete, inadequate and asymmetric information about the asset
Risk processing	Belcher (2010), Fenzl and Pelzmann (2012)	How risk is perceived, assessed, evaluated and absorbed by an investor cognitive processes
Risk framing	Vlaev <i>et al.</i> (2009), Bateman <i>et al.</i> (2011)	Risk framing institutes the context and perspective of risk
Historical risk	Wang <i>et al.</i> (2011)	Calculated risk on the basis of <i>ex post</i> performance
Risk-as-feelings hypotheses	Cheng (2007), Wang <i>et al.</i> (2011),	Feelings-based behavioral model; stress at the time of decision instils anticipatory feelings which drive investor behavior
Risk-availability	Kliger and Kudryavtsev (2010)	Construct of availability heuristic: it refers to the availability of the financial risk from an investor's perspective. This measures the tendency of an investor to weigh recent recall of financial risk higher than comprehensive evaluation
Risk-free rate puzzles	Semenov (2009)	Opposite of equity premium puzzle as discussed in previous section: it refers to puzzle related to inferior returns of risk-free government bonds
Risk attribution	Okuyama and Francis (2007)	Risk attribution is the process of identifying smaller constructs or attributes of total risk
Risk-as-value	Cheng (2007)	Risk-as-value is a combination of analysis (risk-as-analysis methodology) and affect (risk-as-feelings methodology)
Risk disclosures	Hüsser (2015)	Mandatory disclosures pertaining to mutual fund investments termed as risk disclosure were studied

Table III.
Other dimensions of risk studied

the individual investor decision making have been ascertained. The paper also attempts to classify different dimensions of risk as professed by the investor. Additionally, the methodology adopted by different research papers has been categorized on qualitative and quantitative basis in a chronological order.

This paper helps a researcher to understand the gaps in the existing behavioral finance literature and provides scope of future work. Based on the discussions in the earlier sections, we conclude by listing some emerging research areas in the field of behavioral finance.

6.1 Risk determinants and modeling

The proponents of the modern portfolio theory are based on the principle of expected utility maximization. However, behavioral finance studies cited in this research paper advocate that investors follow cognitive heuristic of satisficing that involves examining perceptual risk of the available alternatives until a satisfactory threshold level is met.

A comprehensive and integrated model which captures this subjective risk needs to be developed for investor decision making. This subjective risk should integrate different risk dimensions as identified in the literature.

6.2 Systems view

Investor decision-making models recognize uncertainty as a function of futurity, subjectivity, and include probabilities to estimate the expected future return. Mathematical optimization techniques also formally integrate uncertainty in the decision-making process to evaluate a finite set of alternatives within a given set of constraints. Optimization techniques identify the best possible alternative or rank the alternatives on the basis of expected return. However, these techniques work in a closed system limiting the constraints. A systems view which can study and evaluate the interplay of multiple constraints, criteria and sub-systems and also provide a precise estimation is required.

6.3 Consciousness in decision making

An investor operates under bounded rationality with limits of time, information and cognition. In an experimental controlled setting, even though an investor deliberates before the decision; yet, in the real environment, most of the decisions are based on past experience, heuristics and intuitive appeal. The level of consciousness encompasses both awareness and attention. Greater awareness supports holistic processing of information and an intuitive or instinctive behavior to make quick or accurate decisions, often with imperfect data sets. In light of this, emerging dimensions and role of consciousness in financial decision making needs further investigation.

6.4 Investor classifications

Investors are classified as active and passive investors, naïve and information investors, sophisticated and noise investors, attentive and inattentive investors and others. Apart from these classifications, investors are also affected by peer choices and market movements differently. Group decision making also affects investor decision making. Further research needs to be carried out in this domain.

6.5 Other behavioral variables

Swami (2013) recognizes the role of executive functions in decision making from a psychological, cognitive and normative standpoint. From a psychological perspective, decision making involves evaluating investor decisions in the context of his needs, preferences, emotions and sentiments. Emotional interplay has been identified as moderator influencing investor decision making.

The present review of the behavioral finance literature could not find studies investigating role of mindfulness and religiosity as antecedents of investor performance. However, these variables have been studied in corporate decision making. Mindfulness is the awareness that emerges through paying attention on purpose, in the present moment,

and non-judgmentally to the unfolding of experience moment by moment. Neuroscientists indicate that meditation improves executive functioning (Zeidan *et al.*, 2010). Religiosity is a comprehensive sociological term used to refer to the numerous aspects of religious activity, dedication and belief. Studies indicate that religion plays a significant role in influencing judgment, emotional and motivational qualities, frame of reference based on a connection with a transcendent and ultimate reality (Fernando and Jackson, 2006). Role of mindfulness and religiosity in influencing investor emotions and judgment needs further investigation from the behavioral finance perspective.

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Further reading

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