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Mediating role of fundamental anomalies on the relationship between behavioral factors and investment performance

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ABSTRACT

This study examines the behavioral factors like heuristics, prospect factors, emotions, and social interaction on the investment performance of the listed firms in Saudi Arabia. Furthermore, the association between behavioral factors and investment performance is investigated through the mediating role of fundamental anomalies. For data collection, the questionnaire technique was applied by utilizing the items from existing literature linked with the variables of interest. Furthermore, data were empirically examined through descriptive statistics, demographic analysis, and a two-step (measurement model and structural model) approach using the Statistical Package for the Social Sciences (SPSS) and Smart (partial least squares) PLS. Under the measurement model, the study items' reliability, validity, and internal consistency were investigated. The study findings through the measurement model confirm the reliability and validity of the latent constructs as measured through selected items. On the other side, the structural model affirms a significant and positive impact of emotions, heuristics, and social interaction on investment performance in the Saudi Stock Exchange. Moreover, fundamental anomalies significantly mediate the relationships between heuristics factors and investment performance, emotions and investment performance, and social interactions and investment performance. Conclusively, the empirical findings would greatly support various stakeholders, including existing and proposed investors, financial analysts, stockbrokers, and governmental policymakers interested in judging the role of behavioral factors and market anomalies toward investment performance in Saudi Arabia.

Keywords: investment performance; behavioral factors; market anomalies; Saudi Stock Exchange

1. Introduction

Over the last couple of decades, theoretical and empirical perspectives on the efficient market hypothesis (EMH) have emerged over time[1,2]. Various forces are playing their role in determining market efficiency, like the role of arbitrage, which is supposed to be much more limited and weaker than the EMH. Additionally,

some new studies have provided evidence in favor of EMH, and due to changing market trends, a new field has emerged under the title of behavioral finance in the school of financial markets[3]. Since its emergence, behavioral finance has gotten much attention in the theoretical and empirical literature. The core assumptions of behavioral finance cover the efficient market perspective and provide some new predictions that can be used in the upcoming decision-making process as the investors adopt[3]. In its general context, behavioral finance is a study field that analyzes human behavior in the competitive market. Its vital work is not only dealing with the observation based on controversial discussions[4]. However, behavioral finance goes beyond those discussions, which may lead to bias or any other confused information that may affect the competitive financial market. The core theme of behavioural finance is to examine the attitudes of the investors when they trade with each other and how their interaction affects the dimensions like market performance[5]. In its true sense, financial markets are not found to be fully efficient but unlikely to hold under plausible circumstances, too.

The term heuristic is widely observed in recent and past studies in the theoretical and empirical literature. However, the heuristic theory is defined as something a rule of thumb in which individuals use the situation of risk and uncertainty while making their decision quite simply and efficiently[6]. In this regard, one of the earliest concepts is justified by Kahneman and Tversky[7], who claimed that those who are not rational enough use heuristics in their decision-making process because such individuals are unable to judge the perfect market situation. Meanwhile, three different heuristics have been introduced by Kahneman and Tversky[7] entitled representativeness, availability, and anchoring. After more than four decades, Waweru et al.[8] have added the fourth heuristic, overconfidence. Under the situation of representativeness heuristics, investors buy hot stock and avoid those stocks that have had lower performance in the recent past[8], and such action is known as an overreaction by the investors in the market[9] where more importance is given to those events having good occurrence in the past. Meanwhile, under the anchoring heuristic, people decide based on the stock's past price irrespective of fundamental information and stock price changes[10].

In addition, prospect factors have also gained much attention under the shadow of behavioral finance, directly associated with investment decision-making and performance outlook. Prospect theory claims that losses and gains are valued differently[11]. In this regard, investors in any stock market make decisions based on the title of perceived gain while ignoring the loss factor. The title of emotion is referred to as a set of complex states of feeling that result in different changes in an individual with an ultimate impact on their thought and behavior[12–14]. In this regard, a range of daily decisions is based on the outcomes of anticipation emotions.

Similarly, the investment decision by the investors is also linked with emotional decision-making. Meanwhile, when the investors feel good or experience positive emotions with the gain from the investment and feel bad because of negative emotions when investors face or suffer any loss from the investment[15]. In addition, the claim of anomalies is referred to as those empirical findings inconsistent with the theories of asset pricing behavior[16]. Meanwhile, they indicate inadequacy in the asset-pricing model or market-related inefficiencies. Moreover, fundamental anomalies are those irregularities that determine the intrinsic value of the stock while considering the fundamental value of the stock. Under such anomalies, investors typically focus on stocks that are popular enough while ignoring the fundamental or over-under price changes[16]— meanwhile, the association between market anomalies, which are essential in nature, and investment behavior. For example, Schwert[17] examined the association between market anomalies like fundamental in nature and market efficiency.

It is stated that such anomalies are apparent in nature rather than real. However, such anomalies have a direct impact on determining the market efficiency and different investment horizons, too. As stated earlier, there is a direct association between heuristic factors, prospect factors, emotions, social interactions, and

investment performance, as observed in different stock markets. However, one of the missing parts in the existing body of literature specifies that the mediating role of fundamental anomalies in the literature on behavioral finance in determining the relationship between heuristic factors, emotions, prospect factors, social interaction, and investment performance is not investigated in any study while focusing on the Saudi Stock Exchange till date. This means there is a possibility that the direct association between the stated explanatory variables and investment performance in the Saudi Stock Exchange would also be mediated by fundamental anomalies.

In today's environment, predicting the stock return is among the most significant concerns for investors and various financial analysts. Under the efficient market hypothesis (EMH) title, Fama[18] has provided a substantial contribution while exploring the dynamic relationship between information and stock prices. The Saudi Stock Exchange performance trends have been observed with a mixed output over the past decade. In August 2011, the Tadawul All Share Index stood at 5979 points, which was at 11,279 points in September 2014[19]. This would indicate a significant increase in the stock performance of 5300 over the time span of three and half years. However, just after this outstanding performance, the Tadawul All Share TASI Index has shown a dramatic decline to 6579 until October 2016[19]. This would significantly highlight that the performance outcomes in the Saudi Stock Exchange are not stable but show a dramatic risk as reflected through variation and risk in the investment outlook. Additionally, just after four years, in March 2020, the Tadawul All Share TASI Index reached to 6140 points, which is slightly above the performance level in 2011[19]. This is one of the significant issues linked with the investment performance in the Saudi Stock Exchange, which is determined by various factors.

In addition, because of the higher level of variation in the performance output of the Saudi Stock Exchange. More specifically, an in-depth investigation of the trends in the Saudi Stock Exchange has revealed that it was at its highest level during February 2006 with a total point of 19,503. However, in 2021, it is now working at 11,500 points[19]. Consequently, various factors are believed to determine stock market performance in Saudi Arabia. However, the role of behavioural factors is very significant in nature. For example, Alsabban and Alarfaj[20] have claimed that investors are rational enough to make any investment decision. Their study has considered the behavioural factors of the investors and empirically examines the trends in investment performance for the Saudi Stock market. They have collected the data for the period of 2007–2018 and confirmed that behavioural factor in the form of investors' confidence is leading to higher performance of the turnover in the Saudi Stock Exchange. However, their findings confirm that investors in the Saudi Stock Market are also overconfident.

In parallel, the linkage between behavioural factors and investment performance is also under investigation by a range of researchers[21–23]. In addition, another recent study was conducted by Khawaja and Alharbi[24], which explored the behavioural factors in the Saudi Stock Exchange. They collected the data through 125 investors in the Saudi Stock Market with the help of a randomly distributed questionnaire. The study findings have confirmed that the behavioural factor of the investors is significantly associated with the investment volume. This would indicate enough theoretical and empirical evidence to claim that investment performance in the Saudi Stock Exchange is not an autonomous factor, but it is directly linked with the behavioural characteristics of the investors, which are also under consideration in the present study. This would specify that the behavioural factors of the investors in any stock market have their primary role and are linked with trends and changing market dynamics. Therefore, the present study considers aspects like investment performance as a primary dependent variable due to a higher level of variation and behavioural factors as its key determinants from the context of the Saudi Stock Exchange.

The current body of research examining the connection between behavioral factors and investment

performance has made considerable progress in unraveling the intricate relationship between investor psychology and financial results. However, a noticeable void becomes evident when we delve into the role of fundamental anomalies as mediators in this equation. While there is a substantial body of work on behavioral biases and fundamental anomalies individually, there remains a notable absence of comprehensive investigations into how these two elements intersect and jointly impact investment performance. Furthermore, another core issue observed in the existing literature, both from theoretical and empirical perspectives, is that it is entirely missing while exploring the role of various types of market anomalies as a mediator on the relationship between behavioural factors and investment performance from the context of the Saudi Stock Market. This would specify that although the direct linkage between behavioural factors and investment performance is observed in the literature, literature cannot explore the mediator role of market anomalies between behavioural factors in the Saudi Stock Exchange. Based on the discussion, the current study tries to answer the question: do heuristics factors and prospect factors influence the investment performance in the Saudi Stock Exchange? Do emotions and social interactions influence investment performance in the Saudi Stock Exchange? Do fundamental anomalies mediate the relationship between heuristics factors, prospect factors, emotions, social interactions, and investment performance in the Saudi Stock Exchange?

Considering the regional context of Saudi Arabia, several reasons can be identified for conducting this research based on the given research questions. For example, the Saudi Arabia Stock Exchange functions within an emerging market, where it is common to observe distinct behavioral trends in contrast to well-established markets. Delving into these dynamics can deepen our comprehension of how behavioral factors impact investment results within less-developed financial landscapes. Additionally, Saudi Arabia has instituted significant financial market changes, such as permitting foreign investment, and these alterations can potentially influence how investors behave. Investigating this market can offer timely insights into how regulatory shifts affect the decision-making of investors. Based upon the above given reasons, the current study has been conducted in the region of Saudi Arabia. Based on the conducted research, the empirical outcomes of this study have provided some interesting and meaningful outcomes while examining the relationship between behavioural factors, fundamental anomalies, and investment performance. More specifically, the stated findings have reasonably filled the empirical gaps while providing some significant policy implications specifically for those who are related to the stock market in the region of Saudi Arabia.

Besides, the study has utilized the Smart Partial least squares structural equation modelling (PLS-SEM) approach for analyzing the association between the variables. In this regard, several reasons can be discussed for using the Smart PLS-SEM. For example, the stated approach has been found with wider implications in the modern empirical literature, where the majority of the studies have mainly utilized this method because it is suitable for complex models, giving some robust findings even in the presence of a small sample size, having predictive relevance, effect size of the model, integration of both measurement and structural models, and well investigation for both direct and indirect associations between the variables.

Other sections of the study review the literature, followed by methodology, result, discussion, and conclusions.

2. Literature review

This part reviews the recent literature pertaining to the envisaged variables, in addition to the theoretical underpinnings.

2.1. Theoretical underpinnings

In a competitive market, the title of behavioural finance theory depends on two major foundations. The

first one is limited arbitrage, which suggests that arbitrage in the real-world financial market is far from perfect[25]. It means that various types of securities are imperfect or even have some suitable substitutes. Such practices are making arbitrage riskier, and when the availability of some good alternative/substitutes, arbitrage remains very risky. The second foundation for behavioural finance is associated with the investor's sentiments. It specifies how real-world investors establish their values and beliefs, precisely their demand for the securities. Combined with limited arbitrage, a theory of investor sentiment may help generate precise predictions about the behavior of security prices and returns. The theoretical underpinning of the prospect theory mainly covers the idea of behavioural factors having their influence towards the investment decision. In this regard, the Kahneman and Tversky[7] have provided the initial discussion related to prospect theory and claim that under risky choice options, there are relatively different types of comparisons. It is stated that people are risk-averse about the gains, but they are risk-seekers about the losses. In this way, in the field of behavioural finance, the prospect theory has been considered as seminal work covering several perspectives. Moreover, behavioural finance links with the psyche of the investors where the human emotions and behaviours are very important in making any type of financial decision. Since its establishment to date, various studies have considered the role prospect theory in determining the investment performance too. For example, Gregoriou et al.[26] infer that stock return (investment performance) is mainly driven by the behavioural factors along with the asset pricing. Moreover, the significance of prospect theory is also determined by the Barberis et al.[27] who claim that when contemplating the allocation of funds to a particular stock, investors typically conceptualize the stock by examining its historical returns distribution and subsequently assess this distribution using the principles outlined in prospect theory. Based upon the above discussion, it is inferred that prospect theory is covering the theoretical underpinning in determining the association between the behavioural factors and investment performance.

2.2. Factors affecting the investment performance

In the existing body of literature, a range of factors is identified as having a significant influence on the performance of the stock market and its investment. In this regard, **Table 1** summarizes the range of the determinants influencing the performance of the stock market in different regions, including developed and developing economies. More specifically, the present study has considered the first five indicators as core determinants of stock market performance from the context of the Saudi Stock Exchange. Various reasons have been identified to consider these variables as core determinants/factors affecting the stock exchange performance. Firstly, it is found that these factors are constantly under researchers' observation to determine the trends in stock return and stock market investment performance. Secondly, these factors have provided a shred of significant evidence for their little implication, specifically from the context of the Saudi Stock Exchange, where the trends in investment performance with the help of heuristics, prospect factors, social interaction, emotions, and market anomalies have been observed with a very little attention as only a few studies have been found in this regard. Furthermore, the heuristics are covered under overconfidence, representativeness, anchoring, and availability, whereas the title of prospect factors indicate the titles like regress, disposition effect, escalation of commitment, ambiguity, etc. Additionally, emotions are reflected through anger, fear, surprise, happiness, sadness, disgust, and contempt. Finally, social interaction is added among the core exogenous constructs to reflect the core determinants of investment performance in the Saudi Stock Exchange.

Table 1. Summary for the determinants of investment performance.

No.	Determinants	Overall studies	Studies in Saudi Arabia
Factors under behavioural finance			
1	Heuristics	[16,28–32]	[24,33–35]
2	Prospect factors	[11,27,32,36–39]	[20,24,40,41]
3	Emotions	[42–57]	[58,59]
4	Social interaction	[60–62]	[63,64]
5	Anomalies	[65–77]	[78,79]

2.3. Heuristics

The title of heuristics has gained much attention in the literature due to its broader implications under the shadow of behavioural finance and trends in financial markets in developed and developing economies. It is believed that heuristic theory may be defined as a simple and efficient rule followed by individuals to avoid some complex situation and at the time of absence of reliable information[80]. More specifically, heuristics are accepted as a mental shortcut as opposed to gathering some thorough information. Meanwhile, it is assumed that heuristic is handy in many situations, but mostly, they lead to biased decisions, as expressed by Tversky & Kahneman[81]. Gigerenzer and Gaissmaier[82] have provided their view regarding the heuristic as a type of strategy that ignores part of the specific information to make some quick decisions to avoid some complex methods. Meanwhile, all kinds of heuristics have their core aim, which is to avoid some complex situations, reduce time and effort while following only few clues, integrating less information or analyzing a very little or few available alternatives as well[83].

Due to their significance, the utilization of heuristics in economics and finance literature is widely observed by different authors[84–87]. Various examples of poor decision-making have been specified in the literature, like selling the winders too early and holding the losers for a more extended period of time, under diversification, and many others. One of the core associations of heuristics is observed with the buying and selling decisions in the stock market. Some authors, like Pompian[88], believe education is the most critical tool to address issues like heuristics and biases. Researchers have provided four significant types of heuristics: overconfidence, representativeness, anchoring, and availability, respectively.

Under overconfidence heuristics, researchers specify that a cognitive heuristic bias is like an unwarranted faith in one's intuitive reasoning, cognitive abilities, and judgment. Psychologists believe that overconfidence heuristics may also cause people to overestimate their skills and knowledge[89]. In the words of Chernoff[90], "Too many people overvalue what they are not and undervalue what they are." Such individuals suffer from overconfidence bias. At the same time, some authors believe that the overconfidence heuristic exists because individual investors do not revise their initial assessment while getting some new level of information as they cannot realize how incorrect their level of judgment may be[91].

Furthermore, overconfidence is a cognitive bias that can be summarized as unwarranted faith in one's intuitive reasoning, judgments, and cognitive abilities[88]. The idea of overconfidence stems from a vast number of cognitive psychological research studies in which participants overestimate their predictive skills and the quality of the data they have been provided. In calculating probabilities, participants are poorly calibrated; events they believe are likely to occur are often much less than 100 percent certain to happen. In brief, individuals think they're more intelligent and have more data than they would. For instance, they might get a suggestion from some financial advisor and read something like that on the Internet, and then they are ready to intervene based on their perceived knowledge edge, including making any investment[92].

As per the research findings of Moore and Healy[93], those suffering from overconfidence have three personality attributes: overestimation, over-placement, and over-precision. More specifically, under overestimation, individuals only focus on their skills and believe in their quality of decision making, which can further be examined through over-performance, the chance of success, and level of control. Conversely, over-placement indicates that people consider themselves better than others. Finally, the title of over-precision is based on the assumption that investors are too certain about their level of judgment while keeping aside the risk factors linked with their investment decisions[94].

H1: There is a significant impact of heuristics behavior on the investment performance in the Saudi Stock Exchange.

2.4. Prospect factors

Like other determinants for investment decision-making and performance, the role of prospect factors has also gotten much attention from researchers in recent and past studies. In this regard, the title of prospect theory, as developed by Kahaneman and Tversky[7], cannot be neglected, which is used to define human behaviour and decision-making in the situation of risk and uncertainty[95]. More specifically, it can be explained under prospect theory that many decisions are made by individuals not addressed by the utility theory. However, the type of financial decisions is entirely based on path dependence[32]. The role of prospect factors is widely observed in the literature. For example, some authors have considered it along with the market anomalies[96,97], while others have taken into account the title of prospect theory for determining the level of stock returns[27], portfolio choices[98], a specific type of risk and return dynamics[99], stock market efficiency[100], asset pricing[101], and value and expected return[11], respectively.

More specifically, the association between stock return as investment performance and prospect factors has also been stated theoretically and empirically. Gregoriou et al.[26] have considered a seven-factor asset pricing model for exploring the dynamic relationship between stock return and prospect factors. It is claimed that the single-factor asset pricing model and its multi-factor dimensions are those models that seek investors' expectations for the return on risky assets. Their study has considered the prospect theory for explaining the variation in the assets return while observing the listed securities in the US from 1927 to 2014. Based on the study findings, they have suggested a seven-factor asset pricing model while merging the expected utility and prospect theory. Zhong and Wang[102] justify prospect theory's role in determining corporate bond stock returns. It is claimed that prospect theory, among the most successful descriptive approaches for decision-making, specifically from the context of the US bond market, significantly impacts the return dynamics. Furthermore, factors like loss aversion play a substantial role in predicting the returns of corporate bonds.

H2: There is a significant impact of Prospect Factors on the investment performance in the Saudi Stock Exchange.

2.5. Emotions

Titles like moods and emotions can also be associated with investment decision-making in terms of cognitive biases. Hirshleifer and Shumway[103] found that even with stock returns, sunshine is highly correlated. Sunshine presumably encourages investors to be happy towards investing more, hence feeling more beneficial. Other researchers have also identified the relationship between mood (emotions) and decision-making[104]. Also, quantitative share pricing models include a mood and emotion-affected aspect of judgment. For instance, dividend discount models, such as the Gordon growth model, provide projections of future growth rates for dividends. It may well be that optimism from a good mood contributes to a high dividend growth rate forecast. This upper estimate would mean the estimated (fair) stock price would have

been reasonably high. An unemotional decision-maker seems to be the logical investor of the effective market hypothesis. Emotions and moods may be meaningless pieces of data expressed in stock prices[105].

Pricing model consumers are likely to be specialists. Shiller[106] pointed out that many non-professional investors do not have experience in investment research and pricing models. These will probably be traders of noise driven by rumor and social mood. Social mood is a mental state socially shared[107,108]. Investors without research expertise are especially likely to be affected by social mood while considering investment choices. De Long et al.[109] defined a class of investors whose aspirations were not justified by the basics; they appealed to them all as traders of noise. Unjustified aspirations are called the sentiments of investors. Asset prices can differ from core values for extended periods when investors exchange sentiment. Further proof of the effect of social mood on stock values is given by Edmans et al.[110], using the outcomes of international football (soccer) matches to assess jovial mood.

H3: There is a significant impact of emotions on investment performance in the Saudi Stock Exchange.

2.6. Social interaction

Social interactions refer to the direct interdependence between personal decisions and the decisions and characteristics of everyone else within a collective community, not regulated by markets and enforceable contracts[111]. The most social individuals are also most inclined to be present on the markets because they have more chances to be made convinced of the relevance of the financial investment[112]. The communication between individuals sometimes contributes to their heterogeneity. The problem of confronting social models and the fear of being mistaken in their personal choices encourage one to imitate the behaviours of others. The imitation appears all the more justified since the financial markets form an environment marked by the complexity and the multiplicity of information.

In social psychology, imitation is regarded as a cardinal process for the theories of social training, which explain human behavior by interiorizing the designs, values, standards, and waiting of others. In addition, inside the groups, imitation would be facilitated by the need for conformity, which encourages the adoption of the group's standards to avoid exclusion. So, the most critical consequence of social interaction is herding behavior, i.e., ignoring private information to follow the crowd.

H4: Social interaction significantly impacts investment performance in the Saudi Stock Exchange.

2.7. Market anomalies and their mediating effect

The title of market anomalies has also been examined by researchers, financial analysts, and other policymakers, specifically from behavioural finance, investment decision, and similar perspectives. It is stated that a market anomaly is a market situation or group of situations that may lead to some abnormal return comparatively to normal returns in a given time. Meanwhile, market anomalies (MA) show a semi-strong form of an efficient market hypothesis, indicating that fundamental analysis has some value for individual investors. In addition, MA is also known as market inefficiencies, an aberration in the financial market that cannot be expressed through efficient market hypothesis or EMH[113].

In addition, literature in finance and financial behavior and the trends in financial markets have significantly focused on the title of MA both in developed and developing economies. However, MA is not an autonomous phenomenon but is linked to various factors or indicators. For example, Latif et al.[114] have focused on the factors like market efficiency, MA, and some of the behavioural factors under the shadow of EMH. It is stated that various stock markets in the world are reflecting the title of EMH due to reflecting some good information in the stock prices. However, at the same time, there are some financial markets where situations are not normal, and the functioning of these markets deviates from the rules of EMH. Such situations

are known as MA. However, the nature of such anomalies might be regular or irregular patterns. Del Águila[115] has considered the MA and the psychological factors to examine the trends in behavioural finance. Empirical studies have shown that investors are not considering the factors like risk and return while making any investment decision for a portfolio. However, psychological factors like overreaction, overconfidence, and sentiments are the observations of the investors.

Meanwhile, heuristic-driven factors, frame dependence, and market inefficiency have shaped various portfolios based on different securities. Specifically, the paper stated that overconfidence and overreaction have a significant role in determining investors' behaviour. Yalçın[116] examines the association between market rationality, efficient market hypothesis, and market anomalies. It is stated that market efficiency is a correct theory that specifies the stock's rational pricing. This would justify the argument that the current prices of the securities are very much linked to fundamental values. However, this argument is significantly challenged by the market anomalies, which are sometimes consistent and sometimes not as per the changing market dynamics. The most commonly seen anomalies are the "volume", "volatility", "cash dividends", "equity premium puzzle", and the "predictability".

Chan et al.[117] have considered factors like political uncertainty, market anomalies, and presidential honeymoons. It is stated that the first 100 days of a newly elected president's administration have a significant period for changing specific policies. Considering the theoretical background, it is suggested that investors demand compensation for bearing heightened political risk factors. Patton and Weller[118] have considered the cost of trading market anomalies while developing a general technique. Their paper has provided an excellent extension to the Fama-MacBeth regression to compare the stock returns to factor exposures with those attained through mutual funds. It is estimated that all implementation costs should be considered when going for any trading strategy. Patton and Weller[118] believe the association between investor attention and market anomalies in the US stock market. It is observed that market anomalies are stronger following high than low attention periods, whereas the factor of return on long-short strategy is based on the composite mispricing score during the period of high attention months. Finally, the results are consistent with the notion that high levels of attention can exacerbate investor overreaction to irrelevant information. Based upon the above arguments, **Figure 1** represents the framework of the study. Moreover, the hypotheses are represented as follows;

H5: There is a mediating impact of fundamental anomalies on the relationship between heuristics factors and investment performance in the Saudi Stock Exchange.

H6: There is a mediating impact of fundamental anomalies on the relationship between prospect factors and investment performance in the Saudi Stock Exchange.

H7: There is a mediating impact of fundamental anomalies on the relationship between emotions and investment performance in the Saudi Stock Exchange.

H8: There is a mediating impact of fundamental anomalies on the relationship between social interactions and investment performance in the Saudi Stock Exchange.
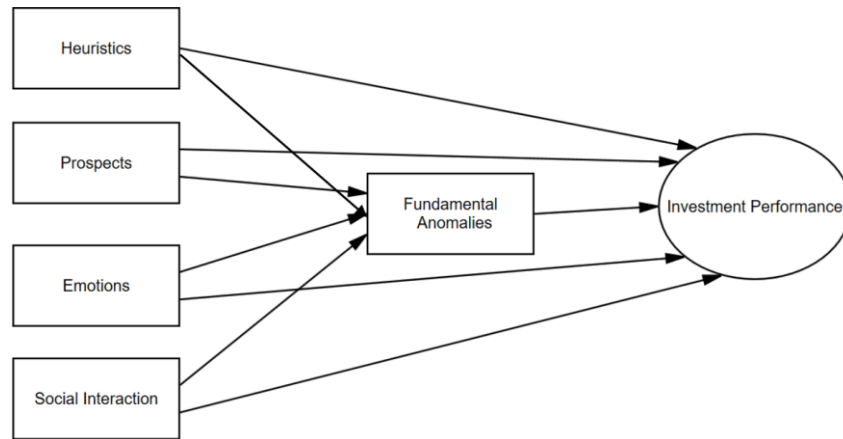
Figure 1. Framework of the study.

3. Research methods

The current study achieves the research objectives for which primary data is gathered through a questionnaire survey. Although there are several benefits and advantages to using the survey-based method; however, its limitations cannot be ignored. For example, the survey-based method may have response bias where the respondents provide answers that they believe are socially acceptable, rather than giving the true opinion. Moreover, the stated method is linked with the sampling bias, where the collected sample may not represent the targeted population. Additionally, the survey-based method may impact on the respondents view as it is mainly focusing on the sentences and words. Moreover, another limitation is that survey-based methods are unable to capture those situational factors having their influence on the respondents and their subsequent responses. On the other side, the considered approach of Smart PLS-SEM is based on several assumptions. For example, the stated approach assumes that the association between the variables of interest is linear in nature, no presence of multicollinearity, non-existence of the endogeneity where the latent constructs are not affected by the error terms, presence of homoscedasticity, and no-autocorrelation in the model.

Different past studies have been considered developing a survey questionnaire. Each stated construct has been measured through their relative statements/items in the questionnaire. All the variables were measured on the 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). **Table 2** (supplementary material) provides the measurement of the study items with the literature sources.

Table 2. Measurement of the variables (supplementary material).

Items title	Heuristics	Measurement scale	Source
HRS1	1) I prefer to invest only in local stocks compared to international stocks.	Strongly agree = 5, strongly disagree = 1.	[119,120]
HRS2	2) When I want to invest in a certain stock, I depend upon the information brokers and friends provide.		
HRS3	3) I prefer to sell stocks when the stock market index decreases.		
HRS4	4) I prefer to buy stocks when the stock market index increases.		
HRS5	5) I usually make an investment decision in stocks with more information available.		
HRS6	6) I believe that my skills and knowledge of the stock market can help me outperform the market.		
HRS7	7) I am confident that I can do better than others in picking stocks.		

Table 2. (*Continued*).

Items title	Prospect	Measuring scale	Source
PRS1	1) After a prior gain, I am more risk seeking than usual.	Strongly agree = 5, strongly disagree = 1.	[121]
PRS2	2) After a prior loss, I become more risk averse.		
PRS3	3) I avoid selling shares that have decreased in value and readily sell shares that have increased in value.		
PRS4	4) I feel more sorrow about holding losing stocks too long than about selling winning stocks too soon.		
PRS5	5) I tend to treat each element of your investment.		
PRS6	6) I ignore the connection between different investment possibilities.		
PRS7	7) When something good happens to me, the positive mood does not last long.		

Items title	Emotions	Measuring scale	Source
EMO1	1) I find it hard to regain my calm after experiencing something negative in the stock market.	Strongly agree = 5, strongly disagree = 1.	[122]
EMO2	2) When talking with the stock market professionals, I am always attuned to their emotional state.		
EMO3	3) There can be long periods when I am not conscious of my bodily and emotional states, as experienced through the stock market.		
EMO4	4) I have sometimes been told that I behaved socially inappropriately because of the changing stock market.		
EMO5	5) I am very good at seeing the positive side of things in the stock market.		

Items title	Social interaction	Measuring scale	Source
SCI1	1) I maintain close social relationships with my friends (investors).	Strongly agree = 5, strongly disagree = 1.	[123]
SCI2	2) I spend a lot of time interacting with my friends (investors).		
SCI3	3) I have frequent communication with my friends (investors).		
SCI4	4) I am a very active person in investment-related conversations.		
SCI5	5) I enjoy talking to people (investors).		

Items title	Investment performance	Measuring scale	Source
INP1	1) The return rate of my recent stock investment meets my expectation.	Strongly agree = 5, strongly disagree = 1.	[124,125]
INP2	2) My rate of return is equal to or higher than the average return rate of the market.		
INP3	3) I feel satisfied with all my investment decisions last year.		
INP4	4) The return on my investment can beat inflation.		
INP5	5) I am financially satisfied with my investment performance.		

Items title	Fundamental anomalies	Measuring scale	Source
FUA1	1) I carefully consider the price fluctuation of stocks I intend to invest in.	Strongly agree = 5, strongly disagree = 1.	[125]
FUA2	2) Before making investment decisions, I study underlying stocks' market fundamentals (economic indicators).		
FUA3	3) I focus on popular stocks for my investment.		
FUA4	4) I overreact to price changes of stocks.		
FUA5	5) I under-react to price changes of stocks.		

This research employed probability-based sampling for simplicity of generalizability. A series of stages accompanies the sampling procedure. Second, a sufficient sample size was calculated for the number of individuals in the population. A technique for assessing the appropriate sample size was suggested by Krejcie and Morgan[126] based on the study population. As stated earlier, 5,586,700 investors (study population),

including male and female members, are currently enrolled in the Saudi Stock Exchange. In this regard, the study population is above 1,000,000; considering Krejcie and Morgan[126] suggestion, the collected sample size should be at least 384 respondents from the Saudi Stock Exchange. Moreover, an online survey was also created for data collection. In this regard, several benefits have been explored for using the online survey to collect the data. For example, the collection of data through online survey has no geographical restrictions for collection the data, low cost, and quick recovery questionnaire[127]. Moreover, the study has collected the data using a team of five members who have assisted the whole procedure of the data collection both in face-to-face and online methods. More specifically, the study has increased the sample size of face-to-face questionnaires by adding 50 more questionnaires so that a better sample size could be achieved. In this regard, a total 427 questionnaires have been distributed by a team of five members among different respondents who are linked with the Saudi Stock Exchange and entitled as investors. During a time span of 8.3 weeks, the team was able to distribute 427 questionnaires among the male and female respondents. Additionally, through an online survey, 73 responses were collected, comprising a sample size of 500. However, a detailed investigation of the collected responses had made it clear that there were approximately 39.60 questionnaires having invalid/no responses whereas, the rest of the questionnaires or 60.40% have been regarded as those having valid responses. Therefore, the valid response rate of 60.40% was achieved. The overall process of the data collection has also been guided well guided by the research work of Jiang et al.[128] and Li et al.[129].

Table 3 provides a description related to the sample response rate.

Table 3. Sample response rate.

Details	Number of Questionnaires	%
Questionnaire as distributed (face-to-face)	427	85.40%
Number of responses through online survey link	73	14.60%
Total responses as received	500	100%
Questionnaires found with invalid/no responses	198	39.60%
Questionnaires with the valid responses	302	60.40%
Valid response rate		60.40%

Moreover, the data was empirically analyzed using a two-step Smart PLS approach.

4. Results and discussion

Following is a detailed discussion of empirical results.

4.1. Demographics of respondents

After checking the various assumptions linked with the data, the current section covers the demographic analysis for which the present study has considered factors like gender, age, qualification, working experience, marital status, and profession of the respondents. **Table 4** covers the frequency of these demographic factors of the study from the various respondents in the Saudi Stock Exchange. The findings show a total of 242 male respondents, whereas only 60 were females. The reason for the higher number of male respondents compared to females implies that in the Saudi Stock Exchange, only a few females are interested in playing their role as investors. Therefore, the female response rate is relatively lower, 19.9%, compared to male members, which is 80.1%. These categories show a percentage share of 80.1% and 19.9%, respectively. Moreover, the age categories of the respondents are determined via different frequencies where it is found that there are 68 respondents (22.5%) in the age category of 20–25, followed by 70 (23.2%) in the age range of 26–30 years, respectively. Additionally, 79 (26.2%) respondents are in the age range of 31–35 years. Finally, 85 respondents

are over 35 years of age, covering a % share of 28.1%. On the other side, in terms of education, **Table 4** indicates that 47 respondents under each category have finished an education below 14 years and equal to 14 years, respectively. These respondents have covered a percentage score of 15.6%. Additionally, 159 respondents show a percentage share of 52.6 and have completed their 16 years of education. Besides, only 49 respondents (16.2%) have covered their education for above 16 years.

In addition, based on the working experience of the respondents, the frequency distribution shows that 75 respondents have an experience of 0–1 year, whereas 76 have experience between the range of 1–2 years. Moreover, those respondents having 1–2 years of experience are 76 in numbers, covering a percentage share of 25.2%. Conversely, respondents with 2–3 years of working experience 58 showed a share of 19.2%. Lastly, 93 respondents have over 3 years of working experience, having a relative share of 30.8%, as shown in **Table 4**. Regarding marital status, the frequency distribution indicates that there are 115 married, 103 single, and 84 other respondents.

Table 4. Demographics of the respondents.

Gender	Frequency	Percent
Male	242	80.1
Female	60	19.9
Total	302	100
Age	**Frequency**	**Percent**
20–25 years	68	22.5
26–30 years	70	23.2
31–35 years	79	26.2
Above 35 years	85	28.1
Total	302	100
Education	**Frequency**	**Percent**
Below 14 years	47	15.6
14 years	47	15.6
16 years	159	52.6
Above 16 years	49	16.2
Total	302	100
Experience	**Frequency**	**Percent**
0–1 year	75	24.8
1–2 year	76	25.2
2–3 years	58	19.2
Above 3 years	93	30.8
Total	302	100
Marital status	**Frequency**	**Percent**
Married	115	38.1
Single	103	34.1
Other	84	27.8
Total	302	100

4.2. Assessment of the measurement model

Convergent validity

After conducting the demographic and descriptive analysis, current research focuses on conducting the measurement model assessment with the help of Smart PLS 3.3.9. The findings have been covered through various statistical outcomes. More specifically, the measurement model or outer model has been checked by examining the individual items' reliability, internal consistency reliability, convergent validity, and discriminant validity of the latent constructs. For this purpose, this research initially discusses the construct reliability and validity while considering the critical latent constructs named heuristics, prospects, social interaction, investment performance, emotions, technical anomalies, fundamental anomalies, and calendar anomalies, respectively. In the existing literature, various studies have supported examining the measurement or outer model through Smart PLS[130–132]. For this purpose, the finding in **Table 5** provides the scores for Cronbach's alpha, rho_A, composite reliability, and average variance extracted. More specifically, the value of Cronbach alpha and composite reliability (CR) help investigate the reliability of the latent constructs[133]. Initially, for checking the reliability of the latent constructs through alpha scores, researchers have provided their valuable opinions regarding the general rule of thumb. For example, an alpha score of 0.70 and above is considered good, 0.80 and above is better, and 0.90 is considered best[134–136]. As per the stated findings in **Table 5**, the results show that alpha scores for the selected latent constructs are, i.e., EMO (0.856), FUA (0.769), HRS (0.818), INP (0.919), PRS (0.909), and SCI (0.888). These values indicate no problem with the reliability of the latent constructs as investigated through the Cronbach alpha approach. However, it is essential to note that some items for the selected latent constructs have been removed due to lower factor loadings to achieve the stated Cronbach alpha, rho_A, CR, and AVE scores.

At the same time, the scores of CR for the latent constructs were entitled as EMO (0.933), FUA (0.855), HRS (0.880), INP (0.939), PRS (0.934), and SCI (0.947). As per the findings in the current literature, it is observed that CR helps in investigating the internal consistency of the scaled items, similar to Cronbach alpha[137]. Another view regarding CR has been provided by Kumar and Singh[138], who claim that CR helps check the overall reliability of a set of items loaded on the specific latent construct. As per suggestion H5, the value of CR for the latent constructs should be a reasonable threshold of anywhere from 0.60 and above[137]. Therefore, the stated findings for the CR indicate that there exists reliability of the latent constructs.

In addition, **Table 5** also shows the values for the average variance extracted (AVE) to validate the latent construct. More specifically, AVE helps analyze the amount of variance captured by the latent construct in relation to the amount of variance due to measurement error[139]. For investigating the acceptable value of AVE as presented by the latent constructs, the researcher believes the value should be higher than the minimum level of 0.50[140]. The findings in **Table 5** cover that AVE for the latent constructs entitled CAA, EMO, FUA, HRS, INP, PRS, SCI, and TEA is 0.874, 0.601, 0.649, 0.755, 0.755, 0.781, and 0.899, accordingly. This would indicate that the AVE scores for all these variables are above the threshold level of 0.60, hence no problem for the discriminant validity in the latent constructs of the study.

Table 5. Convergent validity.

Variables	Items	CFA	C.B alpha	rho_A	CR	AVE
Heuristics	HRS1	0.736	0.818	0.820	0.880	0.649
	HRS2	0.828				
	HRS3	0.864				
	HRS4	0.789				

Table 5. (*Continued*).

Variables	Items	CFA	C.B alpha	rho_A	CR	AVE
Prospects	PRS1	0.906	0.909	0.950	0.934	0.781
	PRS2	0.900				
	PRS3	0.855				
	PRS4	0.872				
Emotions	EMO4	0.933	0.856	0.856	0.933	0.874
	EMO5	0.937				
Social interaction	SCI4	0.949	0.888	0.888	0.947	0.899
	SCI5	0.947				
Investment performance	INP1	0.865	0.919	0.919	0.939	0.755
	INP2	0.870				
	INP3	0.886				
	INP4	0.850				
	INP5	0.874				
Fundamental anomalies	FUA1	0.583	0.769	0.776	0.855	0.601
	FUA2	0.848				
	FUA3	0.813				
	FUA4	0.828				
	CAA2	0.858				
	CAA3	0.857				
	TEA2	0.891				
	TEA3	0.798				

Note: HRS: heuristics; PRS: prospects; EMO: emotions, SCI: social interaction; INP: investment performance; CAA: calendar anomalies; TEA: technical anomalies.

4.3. Discriminant validity

Under the measurement model, the checking of construct reliability and validity has provided evidence that there is no problem with the study variables measured through selected items. In the subsequent step, this research considers the testing for the discriminant validity of the latent variables. In this regard, current literature has provided several methods where the titles like Fornell-Larcker criterion, loadings, cross-loadings, and Heterotrait-monotrait ratio of correlations (HTMT) ratio have gotten much attention in recent years. These methods are widely recognized in contemporary studies[141–143]. More specifically, **Table 6** shows the findings for the Fornell-Larcker criterion for the latent constructs. This method helps analyze the degree of shared variance between the latent variables. Based on this Fornell-Larcker criterion, it is stated that the square root of a latent variable must be greater than the correlation between the construct and any other construct in the model. As per the findings in **Table 6**, it is found that the diagonal values cover the square root of AVE for every single latent construct named EMO, FUA, HRS, INP, PRS, and SCI, respectively. More specifically, the findings show that the square roots for these variables were as follows: 0.935, 0.775, 0.805, 0.869, 0.884, and 0.948. Moreover, the values shown in the off-diagonal under **Table 6** are comparatively lower than the diagonal values, which means that discriminant validity exists between the stated variables.

Table 6. Fornell-Larcker criterion.

	EMO	FUA	HRS	INP	PRS	SCI
EMO	0.935	-	-	-	-	-
FUA	0.700	0.775	-	-	-	-
HRS	−0.108	−0.088	0.805	-	-	-
INP	0.249	0.520	−0.022	0.869	-	-
PRS	0.222	0.153	0.075	0.171	0.884	-
SCI	0.298	0.435	0.068	0.497	0.327	0.948

Note: HRS: heuristics; PRS: prospects; EMO: emotions; SCI: social interaction; INP: investment performance; CAA: calendar anomalies; TEA: technical anomalies.

In the further step, the discriminant validity for the latent construct has been investigated through loadings and cross-loadings for the items linked with the latent variables. The loadings values (**Table 7**) for the key items of EMO have been recorded as 0.933 and 0.937, respectively. Moreover, the items for the FUA, HRS, INP, PRS, SCI, and TEA have represented the factors loadings 0.583, 0.848, 0.813, 0.828, 0.739, 0.828, 0.736, 0.828, 0.864, 0.789, 0.865, 0.870, 0.886, 0.850, 0.874, 0.906, 0.900, 0.855, 0.872, 0.949, and 0.947, respectively. These factors' loadings of the relative latent constructs are also higher than the cross-loadings, as shown in **Table 7**. This would indicate the argument that the second measure of the discriminant validity for the latent constructs has also fulfilled the assumption, hence no problem for the discriminant validity. It is important to note that those items with lower loadings below 0.50 were deleted from the model. These items were entitled HRS5, HRS6, HRS7, PRS5, and PR6, RRS7, EMO1, EMO2, EMO3, and FUA5.

Table 7. Loadings and cross loadings.

Items	EMO	FUA	HRS	INP	PRS	SCI
EMO4	0.933	0.637	−0.101	0.248	0.155	0.260
EMO5	0.937	0.671	−0.101	0.219	0.258	0.295
FUA1	0.269	0.583	−0.012	0.681	0.065	0.325
FUA2	0.726	0.848	−0.110	0.280	0.143	0.361
FUA3	0.514	0.813	−0.080	0.322	0.084	0.267
FUA4	0.614	0.828	−0.063	0.337	0.169	0.376
HRS1	−0.104	−0.080	0.736	−0.035	0.042	0.046
HRS2	−0.097	−0.064	0.828	0.010	0.104	0.080
HRS3	−0.068	−0.076	0.864	−0.032	0.068	0.042
HRS4	−0.079	−0.062	0.789	−0.015	0.025	0.048
INP1	0.237	0.446	0.002	0.865	0.114	0.403
INP2	0.232	0.470	−0.033	0.870	0.146	0.426
INP3	0.208	0.444	−0.025	0.886	0.182	0.440
INP4	0.173	0.438	−0.032	0.850	0.163	0.462
INP5	0.233	0.460	−0.005	0.874	0.139	0.428
PRS1	0.213	0.166	0.051	0.206	0.906	0.326
PRS2	0.249	0.159	0.103	0.162	0.900	0.273
PRS3	0.134	0.071	0.054	0.091	0.855	0.285
PRS4	0.163	0.117	0.059	0.112	0.872	0.261
SCI4	0.283	0.405	0.073	0.466	0.297	0.949
SCI5	0.281	0.420	0.055	0.477	0.323	0.947

Note: HRS: heuristics; PRS: prospects; EMO: emotions; SCI: social interaction; INP: investment performance.

In addition, the third method to examine the discriminant validity of the latent variable is entitled as HTMT ratio. This approach was introduced by Henseler[144] based on the variance-based structural equation modeling approach. HTMT helps in investigating the similarity between the latent variables. More specifically, based on the HTMT ratio, it is inferred that if the HTMT ratio is below 1, there is discriminant validity between the latent constructs of the study. Moreover, the HTMT ratio of 0.80 is also acceptable in various other cases. At the same time, it is pretty convenient to measure the HTMT ratio as it is based on the correlation between the observed variables of the study. As per the findings in **Table 8**, the HTMT ratio of the latent variables is reasonably lower than 1, indicating enough evidence to justify the discriminant among the stated variables as measured through their relative items.

Table 8. HTMT ratio.

	EMO	FUA	HRS	INP	PRS	SCI
EMO	-	-	-	-	-	-
FUA	0.852	-	-	-	-	-
HRS	0.129	0.114	-	-	-	-
INP	0.282	0.627	0.039	-	-	-
PRS	0.242	0.177	0.087	0.175	-	-
SCI	0.341	0.524	0.079	0.550	0.359	-

Note: HRS: heuristics; PRS: prospects; EMO: emotions; SCI: social interaction; INP: investment performance.

4.4. Structural model and hypotheses testing

In the previous section, the current study provided a meaningful discussion based on the empirical findings for checking the outer or measurement model. This section mainly deals with the structural or internal model assessment for various statistical outcomes. This study consists of several research hypotheses. More specifically, H1 to H4 cover the direct relationship between independent variables and investment performance, whereas the rest of the hypotheses explore the mediating/indirect relationship between the variables of interest. To examine the partial, full, or no mediation, it is essential to investigate the direct relationship between independent and dependent variables of interest. H1 to H4 have been hypothesized for the direct relationship between heuristics, prospects, emotions, social interaction, and investment performance. On the other side, the mediating effect of fundamental anomalies has been examined through H5–H8, respectively.

Structural model and hypotheses testing (estimation of direct effects)

Effect of heuristics on investment performance

The relationship between heuristics and investment performance has been hypothesized under H1, indicating a significant impact of heuristics on the investment performance in the Saudi Stock Exchange. **Figure 2** covers the structural model relationship between heuristics and investment performance from the context of the Saudi Stock Exchange.
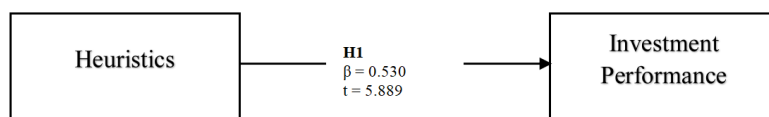

Figure 2. Estimation of direct relationship (heuristics with investment performance).

Table 9 shows that the heuristics coefficient is 0.530 with a standard deviation of 0.090. This means that there is a positive impact of heuristics on the investment performance among the selected respondents of the Saudi Stock Exchange. Moreover, through this coefficient and standard deviation, the value of *T*-statistics is

5.889, indicating an above-threshold level of 1.96. The stated score of 5.886 helps achieve the *P*-value of 0.000, which is significant at 1%. This shows a direct and significant impact of heuristics on investment performance in the selected stock market. More specifically, it shows that the heuristic among the selected respondents is causing a positive shift in investment performance, indicating another behavioral factor's significance. The heuristic title helps individuals use the rule of thumb under uncertainty; consequently, in the Saudi Stock Market, such a rule of thumb is observed as a significant determinant of investment performance.

Table 9. Hypothesis testing H1 (direct effects).

Hypothesis	Relationships	Path coefficients	*T*-value	*P*-value	Result
H1	HRS → INP	0.530	5.889	0.000***	Failed to reject

Note: ***, **, * indicates a level of significance at 1%, 5%, and 10%, respectively; HRS = heuristics, INP = investment performance.

Effect of prospects on investment performance

The relationship between prospects and investment performance has been hypothesized under H2, indicating a significant impact of prospect factors on the investment performance in the Saudi Stock Exchange. **Figure 3** covers the structural model relationship between prospects and investment through the beta coefficient, *T*-value.
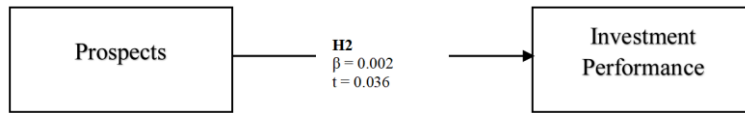

Figure 3. Estimation of direct relationship (prospects with investment performance).

Moreover, **Table 10** shows that the coefficient of PRS to INP is 0.002 with a standard deviation of 0.053. Furthermore, this coefficient and standard deviation show a *T*-score of 0.036 and a *P*-value of 0.971, respectively. As the *T*-score is less than the threshold level of 1.96; therefore, the findings show that H2 is rejected.

Table 10. Hypothesis testing H2 (direct effects).

Hypothesis	Relationships	Path coefficients	*T*-value	*P*-value	Result
H2	PRS → INP	0.002	0.036	0.971	Reject

Note: ***, **, * indicates a level of significance at 1%, 5%, and 10%, respectively; PRS = prospects, INP = investment performance.

Effect of emotions on investment performance

The relationship between emotions and investment performance has been hypothesized under H3, indicating a significant impact of emotions on investment performance. **Figure 4** covers the structural model relationship between emotions and investment performance through the beta coefficient and *T*-value.
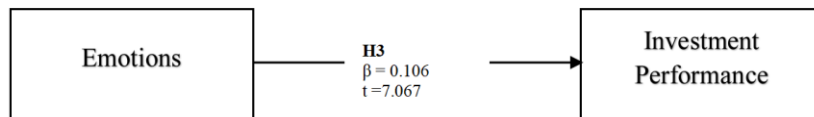

Figure 4. Estimation of direct relationship (emotions with investment performance).

The results under **Table 11** show that the coefficient for EMO is 0.106, which indicates a positive impact on the investment performance among the selected respondents in the Saudi Stock Exchange. More specifically, the standard deviation value in the coefficient based on the original sample is 0.015, which provides the *T*-statistics of 7.067. This *T*-value is higher than the threshold level of 1.96, which means that there is a significant

and positive impact of EMO on INP among the study respondents. Moreover, *T*-statistics of 7.067 provides a *P*-value of 0.000, significant at 1%. Based on these findings, it is inferred that there is a significant and positive impact of EMO on INP, reflecting that respondents' emotions are the direct source in determining their investment performance.

Table 11. Hypothesis testing H3 (direct effects).

Hypothesis	Relationships	Path coefficients	*T*-value	*P*-value	Result
H3	EMO → INP	0.106	7.067	0.000***	Failed to reject

Note: ***, **, * indicates a level of significance at 1%, 5%, and 10%, respectively; EMO = emotions, INP = investment performance.

Effect of social interaction on investment performance

The relationship between social interaction and investment performance has been hypothesized under H4, indicating a significant impact of social interaction on investment performance. **Figure 5** covers the structural model relationship between social interaction and investment performance through the beta coefficient and *T*-value.
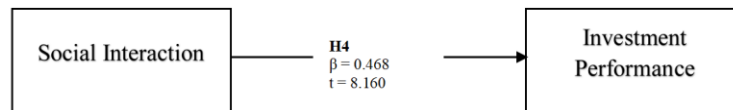

Figure 5. Estimation of direct relationship (social interaction with investment performance).

Finally, as per the direct findings, **Table 12** shows that the coefficient for social interaction is 0.468, with a standard deviation of 0.057. These values have provided the *T*-statistics of 8.160 and *P*-value of 0.000. As the *P*-value is significant at 1%, it is stated that SCI has a significant and positive impact on INP in the Saudi Stock Market.

Table 12. Hypothesis testing H4 (direct effects).

Hypothesis	Relationships	Path coefficients	*T*-value	*P*-value	Result
H4	SCI → INP	0.468	8.160	0.000***	Failed to reject

Note: ***, **, * indicate a level of significance at 1%, 5%, and 10%, respectively; SCI = social interaction, INP = investment performance.

4.5. Mediation analysis

The testing of the mediating effect is based on the various assumptions and statistical associations between the variables of interest. For example, the indirect paths are significant to verify that various market anomalies mediate the relationship between independent and dependent variables. To examine the significance of the indirect paths, the sampled table generated through the bootstrapping option under Smart PLS has been copied and pasted into MS-Excel to compute the standard deviation value to achieve the *T*-statistics of the relative coefficients. Hair et al.[145] claim that standard deviation equals the standard error under bootstrapping. The findings under **Table 13** indicate that after adding the mediating effect of fundamental anomalies, the direct relationship between heuristics and investment performance, PRS and INP, EMO and INP, and SCI and INP is found to be statistically insignificant. However, **Table 13** indicates that HRS's impact on the first mediator (FUA) is 0.330 with a *T*-value of 2.90, respectively. Additionally, the impact of FUA on INP is 0.471, with a *T*-value of 5.898. This would indicate that the path from HRS to FUA and from FUA INP is significant.

In addition, **Table 13** shows that the path from PRS to FUA is negatively insignificant, indicating no association between PRS and the mediator entitled as fundamental anomalies. On the other hand, the impact

of EMO on FUA is 0.631, significant at 1%. Moreover, social interaction (SCI) also indicates a coefficient of 0.273 with a *P*-value of 0.000. At the same time, the findings under **Table 13** confirm that the path between HRS to CAA and CAA to INP is positively significant at 1%. More specifically, the path coefficient between HRS to CAA is 0.497, and between CAA to INP is 0.268. Apart from this, the path between HRS to TEA is −0.06, which is insignificant at 5%. However, the path between TEA to INP is 0.221, with a *T*-value of 3.85.

The third independent variable under the present study is EMO, which shows its relationships with FUA at a coefficient of 0.631, significant at 1%. Similarly, the path between EMO to CAA is 0.128, significant at 5%. However, the path between EMO to the third mediator entitled TEA is 0.051 with a *P*-value of 0.389, indicating an insignificant path. Conversely, the path between SCI and FUA shows a positively significant coefficient. Similarly, the path between SCI to CAA and SCI to TEA is also positively significant at 5%. These findings have provided enough evidence to move on to the next step in analyzing the strength of the mediating effect as determined by fundamental anomalies, calendar anomalies, and technical anomalies, respectively.

Table 13. Path coefficients.

Directions	Original sample (O)	Standard deviation (STDEV)	*T*-statistics (O/STDEV)	*P*-values
EMO → FUA	0.631	0.044	14.246	***
EMO → INP	0.204	0.170	1.212	NS
FUA → INP	0.471	0.080	5.898	***
HRS → FUA	0.330	0.113	2.901	**
HRS → INP	0.017	0.053	0.325	NS
PRS → FUA	−0.074	0.045	1.637	NS
PRS → INP	0.027	0.054	0.495	NS
SCI → FUA	0.273	0.047	5.837	***
SCI → INP	0.251	0.165	1.521	NS

Note: HRS: heuristics; PRS: prospects; EMO: emotions; SCI: social interaction; INP: investment performance; NS: not significant; *, **, *** significant at 10%, 5%, and 1%, respectively.

To investigate the strength of the mediating effect by stated mediators under the present study, variance account for (VAF) was suggested by Hair et al.[145]. The findings in **Table 14** provides the outcomes for the VAF considering both direct and indirect effect with the presence of the mediator. The results show that the VAF for FUA as a mediator on the relationship between EMO and INP is 59.30. As per the findings in the existing literature, it is observed that if the value of VAF is less than 20%, it will be regarded as no mediation. In contrast, the value of VAF between 20–80 would reflect partial mediation. However, if the value of VAF is above 80%, it would be inferred that there is a full mediation[146]. The present findings illustrated in **Table 14**, the VAF is found to be 59.30, which falls in the range of 20%–60%; hence it is inferred that there is a partial mediating effect of FUA on the relationship between EMO and INP. **Figure 6** indicates the mediating effect of FUA between EMO and INP.
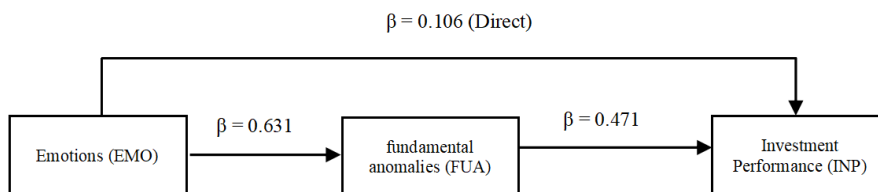

Figure 6. Estimation of indirect path (EMO → FUA → INP).

Table 14. VAF for FUA between EMO and INP.

Effects	Path	Path coefficient	Indirect effect	Standard deviation	Total effect	VAF	*T*-value	*P*-value	Decision
Direct without mediator	EMO → INP	0.106	-				7.070	***	Fail to reject
Indirect with mediator	EMO → INP	0.204	-		0.501	59.300	4.251	***	Fail to reject
	EMO → FUA	0.631	0.297	0.070					
	FUA → INP	0.471							

Note: HRS: heuristics; PRS: prospects; EMO: emotions; SCI: social interaction; INP: investment performance; NS: not significant, *, **, *** significant at 10%, 5%, and 1%, respectively.

The finding under **Table 15** provides the outcome for the VAF while dealing with the mediating effect of FUA between HRS and INP. The results show that the indirect effect of the mediating role of FUA between HRS and INP shows a significant outcome with a *T*-value of 2.05. This would indicate a significant mediating effect of FUA on the relationship between HRS and INP in the Saudi Stock Exchange. Moreover, the VAF for this relationship is found to be 90.14%. As the value of VAF is above 0.80; therefore, it is claimed that there is a full mediating effect of FUA on the relationship between HRS and INP. **Figure 7** indicates the mediating effect of fundamental anomalies on the relationship between heuristics and investment performance.
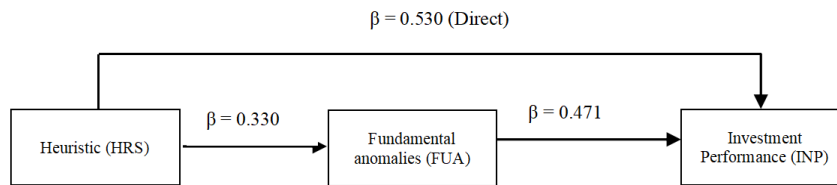
β = 0.530 (Direct)

Figure 7. Estimation of Indirect Path (HRS → FUA → INP).

Table 15. VAF for FUA between HRS and INP.

Effects	Path	Path coefficient	Indirect effect	Standard deviation	Total effect	VAF	*T*-value	*P*-value	Decision
Direct without mediator	HRS → INP	0.530	-				5.889	***	Fail to reject
Indirect with mediator	HRS → INP	0.017	-		0.170	90.140	2.030	**	Fail to reject
	HRS → FUA	0.330	0.155	0.076					
	FUA → INP	0.471							

Note: HRS: heuristics; PRS: prospects; EMO: emotions; SCI: social interaction; INP: investment performance; NS: not significant; *, **, *** significant at 10%, 5%, and 1%, respectively.

Table 16 indicates the VAF while dealing with the mediating effect of FUA between SCI and INP. The results show that the indirect effect of FUA's mediating role between HRS and INP shows a significant outcome with a *T*-value of 2.03. This would indicate a significant mediating effect of FUA on the relationship between SCI and INP in the Saudi Stock Exchange. Moreover, the VAF for this relationship is found to be 33.71%. As the value of VAF is between 20%–80%; therefore, it is claimed that there is a partial mediating effect of FUA on the relationship between SCI and INP. **Figure 8** indicates the indirect relationship between SCI, FUA, and INP.
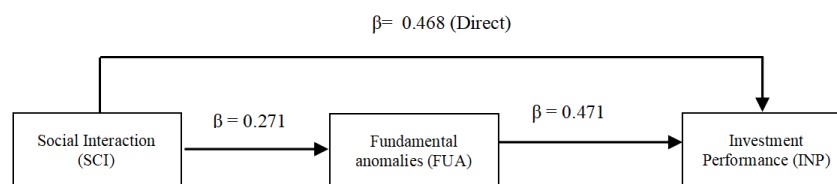
β= 0.468 (Direct)

Figure 8. Estimation of indirect path (SCI → FUA → INP).

Table 16. VAF for FUA between SCI and INP.

Effects	Path	Path coefficient	Indirect effect	Standard deviation	Total effect	VAF	*T*-value	*P*-value	Decision
Direct without mediator	SCI → INP	0.468	-				8.160	***	Fail to Reject
Indirect with mediator	SCI → INP	0.251	-		0.380	33.710	2.030	**	Fail to Reject
	SCI → FUA	0.271	0.127	0.063					
	FUA → INP	0.471							

Note: HRS: heuristics; PRS: prospects; EMO: emotions; SCI: social interaction; INP: investment performance; CAA: calendar anomalies; TEA: technical anomalies; NS: not significant; *, **, *** significant at 10%, 5%, and 1%, respectively.

As per the findings in **Table 17**, the value of R^2 in the main dependent variable (INP) is recorded as 0.262, indicating an overall change of 26.2% in the investment performance due to heuristics, prospects, social interaction, and emotions. This means that collectively, these exogenous constructs are causing a change of 26.2% in the investment performance. Moreover, the adjusted R^2 has been found to be 25.2%.

Table 17. R^2 and adjusted R^2 of the model.

Dependent variable	R square	R square adjusted
INP	0.262	0.252

Considering the above empirical findings, there are few but remarkable economic interpretations. For example, the relationship between behavioural factors and investment performance indicates that investors in the stock market of Saudi Arabia need to focus on the stated behavioural factors having their significant role. More specifically, behavioural factors represent some of the emotional context, which further determines the trends in investment-related outcomes. Additionally, the behavioural factors mostly focus on the investors' sentiments, which can further drive the market movement. It means that focusing on the behavioural factors like emotions, heuristics and social interaction towards the investment performance is substantially important in the changing market environment where both micro and macroeconomic factors exist. Additionally, the study further highlights the need for the consideration of the fundamental anomalies in determining the nexus between behavioral factors and investment performance. When formulating investor protection regulations or market oversight measures, policymakers can take into account the mediating role. Recognizing how fundamental anomalies play a part in conveying the influence of behavioral factors can guide the development of policies aimed at improving market stability, diminishing information imbalances, and protecting the interests of investors.

5. Conclusion

This research has explored the direct impact of behavioral factors entitled heuristics, emotions, social interaction, and prospects on investment performance in the Saudi Stock Exchange. Moreover, it explores the mediating role of fundamental anomalies in the relationships between behavioral factors and investment performance. The findings show a significant impact of behavioural factors entitled heuristics, emotions, and social interaction on investment performance in the Saudi Stock Exchange. Moreover, the mediating effect indicates that fundamental anomalies' significant role exists in the relationship between behavioural factors and investment performance. Based on the findings, the following are the implications of the study.

The current study has provided several practical implications based on the empirical findings. For example, this study can be viewed in that it can provide guidelines to various investors, financial brokers, and similar individuals having their direct or indirect linkage with the Stock Market of Saudia Arabia. The results

show that behavioral factors like heuristics, social interaction, and emotions directly determine investment performance. For this purpose, investors and similar other individuals are highly suggested to consider the significance of these behavioral factors while analyzing the trends in the investment performance in the region of Saudi Arabia. Moreover, financial analysts and brokers are advisors to various community members and business groups for making investment decisions regarding financial securities with positive returns. At the same time, behavioral finance researchers can also utilize the study findings to check the role of heuristics, social interaction, and emotions toward investment performance in the region of Saudi Arabia. Moreover, current and proposed future investors may also consider behavioral factors' significance and determinantal role in achieving higher investment returns.

In addition, the practical implication of this study can also be viewed while considering the mediating role of market anomalies on the relationships between behavioral factors and investment performance. More specifically, investors are highly suggested to focus on all three market anomalies: fundamental anomalies, calendar anomalies, and technical anomalies. Considering such market-based factors would also highlight the importance of similar other variables in justifying the trends in investment performance. Therefore, it is suggested that individuals linked with the stock markets tend to examine market anomalies and behavioral factors.

Finally, the implication of this study can be demonstrated for the policymakers as linked with the financial market of the Kingdom of Saudi Arabia (KSA). For example, those government officials and administrative representatives constantly working for the economic and financial development in the region of KSA highly recommend focusing on the association between behavioral factors, market anomalies, and investment performance. This is because analyzing the trends in investment performance as determined through behavioral factors is significantly important for developing strategic policies related to the stock market, investment performance, investment trends, and social behaviors of the proposed investors.

Besides, the current study has several limitations through which future directions can be proposed. For example, this study is mainly focusing on the investment performance from the context of behavioural factors. It entirely neglects the role of both micro and macro risk factors having their ultimate influence on the investment performance. Moreover, the study has been conducted in the regional context of Saudi Arabia, hence it is a limited practical implication. Additionally, the study is based on the quantitative research design with no consideration of a mixed approach. It is suggested that future studies need to address these limitations by expanding the consideration of micro and macro-level risk factors, cross-regional comparisons, and implications of mixed-method research techniques.

Author contributions

Conceptualization, ASA; methodology, ASA and SR; software, ASA and HWK; validation, ASA, SR and AA; formal analysis, ASA and SR; investigation, ASA, SR and AA; resources ASA; data curation, ASA, HGHS; writing—original draft preparation, ASA, SR and AA; writing—review and editing, ASA, SR, AA, HWK and HGHS; visualization, SR and HWK; supervision, SR, AA, HWK and HGHS; project administration, ASA and SR; funding acquisition, ASA. All authors have read and agreed to the published version of the manuscript.

Conflict of interest

The authors declare no conflict of interest.

References

1. Rossi M, Gunardi A. Efficient market hypothesis and stock market anomalies: Empirical evidence in four European countries. *Journal of Applied Business Research* 2018; 34(1): 183–192. doi: 10.19030/jabr.v34i1.10111

2. Sánchez-Granero MA, Balladares KA, Ramos-Requena JP, Trinidad-Segovia JE. Testing the efficient market hypothesis in Latin American stock markets. *Physica A: Statistical Mechanics and Its Applications* 2020; 540: 123082. doi: 10.1016/j.physa.2019.123082

3. Kapoor S, Prosad JM. Behavioural finance: A review. *Procedia Computer Science* 2017; 122: 50–54. doi: 10.1016/j.procs.2017.11.340

4. Ogunlusi OE, Obademi O. The impact of behavioural finance on investment decision-making: A study of selected investment banks in Nigeria. *Global Business Review* 2019; 22(9): 0972150919851388. doi: 10.1177/0972150919851388

5. Forbes W. *Behavioural Finance.* John Wiley & Sons; 2009.

6. Tversky A, Kahneman D. Availability: A heuristic for judging frequency and probability. *Cognitive psychology* 1973; 5(2): 207–232.

7. Kahneman D, Tversky A. Prospect theory: an analysis of decisions and the psychology of choice. *Econometrica* 1979; 47: 313–327.

8. Waweru NM, et al. The effects of behavioural factors in investment decision-making: a survey of institutional investors operating at the Nairobi Stock Exchange. *International Journal of Business Emerging Markets* 2008; 1(1): 24–41.

9. De Bondt WF, Thaler R. Does the stock market overreact? *The Journal of finance* 1985; 40 (3): 793-805.

10. Montier J, Strategy GE. Applied behavioural finance: Insights into irrational minds and market. 2002; Unpublished work.

11. Eom C, Park JW. Effects of the fat-tail distribution on the relationship between prospect theory value and expected return. *The North American Journal of Economics Finance* 2020; 51: 101052.

12. Fischer P, Greitemeyer T. Music and aggression: The impact of sexual-aggressive song lyrics on aggression-related thoughts, emotions, and behavior toward the same and the opposite sex. *Personality Social Psychology Bulletin* 2006; 32(9): 1165–1176.

13. Poduska JM, Kellam SG, Wang W, et al. Impact of the good behavior game, a universal classroom-based behavior intervention, on young adult service use for problems with emotions, behavior, or drugs or alcohol. *Drug Alcohol Dependence* 2008; 95: S29–S44.

14. Andrade EB, Ariely D. The enduring impact of transient emotions on decision making. *Organizational Behavior and Human Decision Processes* 2009; 109(1): 1–8.

15. Cheng PYK. Decision utility and anticipated discrete emotions: An investment decision model. *Journal of Behavioral Finance* 2014; 15(2): 99–108.

16. Abdin SZ, Farooq O, Sultana N, Farooq M. The impact of heuristics on investment decision and performance: Exploring multiple mediation mechanisms. *Research in International Business Finance* 2017; 42: 674–688.

17. Schwert GW. Anomalies and market efficiency. In: *Handbook of the Economics of Finance*. Elsevier; 2003; pp. 939–974.

18. Fama EF. The behavior of stock-market prices. *The Journal of Business* 1965; 38(1): 34-105.

19. Economics T. Saudi Arabia Stock Market (TASI). Available online: https://tradingeconomics.com/saudi-arabia/stock-market (accessed on 2 August 2023).

20. Alsabban S, Alarfaj O. An empirical analysis of behavioral finance in the Saudi Stock Market: Evidence of overconfidence behavior. *International Journal of Economics Financial Issues* 2020; 10(1): 73–86.

21. Akhtar F, Das N. Investor personality and investment performance: From the perspective of psychological traits. *Qualitative Research in Financial Markets* 2020; 12(3): 333–352.

22. Kengatharan L, Kengatharan N. The influence of behavioral factors in making investment decisions and performance: Study on investors of Colombo Stock Exchange, Sri Lanka. *Asian Journal of Finance & Accounting* 2014; 6(1): 1.

23. Keswani S, Dhingra V, Wadhwa B. Impact of behavioral factors in making investment decisions and performance: Study on investors of National Stock Exchange. *International Journal of Economics and Finance* 2019; 11(8): 80.

24. Khawaja MJ, Alharbi ZN. Factors influencing investor behavior: an empirical study of Saudi Stock Market. *International Journal of Social Economics* 2021; 48(4): 587–601.

25. Firat D, Fettahoglu S. Investors' purchasing behaviour via a behavioural finance approach. *International Journal of Business Management* 2011; 6(7): 153–163.

26. Gregoriou A, Healy JV, Le H. Prospect theory and stock returns: A seven factor pricing model. *Journal of Business Research* 2019; 101: 315–322.

27. Barberis N, Mukherjee A, Wang B. Prospect theory and stock returns: An empirical test. *The Review of Financial Studies* 2016; 29(11): 3068–3107.

28. Figueiredo PS, Loiola E. The impact of project introduction heuristics on research and development performance. *RAI Revista de Administração e Inovação* 2017; 14(2): 151–161.

29. Gino F, Pisano G. *Do Manager's Heuristics Affect R & D Performance Volatility? A Simulation Informed by the Pharmaceutical Industry.* Harvard Business School; 2006.

30. Johnson J, Tellis GJ. Blowing bubbles: Heuristics and biases in the run-up of stock prices. *Journal of the Academy of Marketing Science* 2005; 33(4): 486–503.

31. Zeferino FRM. *Investor Heuristics Measurement and Return Predictability—A Behavioural Finance Study* [Master's thesis]. Nova School of Business and Economics; 2021.

32. Mahmood Z, Kouser R, Abbas SS, Saba I. The effect of hueristics, prospect and herding factors on investment performance. *Pakistan Journal of Social Sciences* 2016; 36(1): 475–484.

33. Alsedrah IT. Influence of heuristics and framing factors on speculating and investment behavior: Evidence from individual traders in the Saudi Stock Market/Ibrahim Tawfeeq Alsedrah. In: *The Doctoral Research Abstracts.* IGS Biannual Publication; 2016.

34. Olatunji SO, Al-Ahmadi MS, Elshafei M, Fallatah YA. Saudi Arabia stock prices forecasting using artificial neural networks. In: Proceedings of the Fourth International Conference on the Applications of Digital Information and Web Technologies (ICADIWT 2011); 4–6 August 2011; Stevens Point, WI, USA. pp. 81–86.

35. Kumaran S. Impact of personal epistemology, heuristics and personal attributes on investment decisions. *International Journal of Financial Research* 2013; 4(3): 62.

36. Lee BS, Li L. The idiosyncratic risk-return relation: A quantile regression approach based on the prospect theory. *Journal of Behavioral Finance* 2016; 17(2): 124–143.

37. Ohk S, Ju BG. Capitalizing on prospect theory value: The Asian developed stock markets. *Japan the World Economy* 2021; 57: 101042.

38. Wang J, Wu C, Zhong X. Prospect theory and stock returns: Evidence from foreign share markets. *Pacific-Basin Finance Journal* 2021; 69: 101644.

39. Li L, Hwang NCR. Prospect Theory and Earnings Manipulation: Examination of the Non-Uniform Relationship between Earnings Manipulation and Stock Returns Using Quantile Regression. Available online: http://130.217.226.42/wai/econwp/1725_Li_Hwang.pdf (accessed on 2 August 2023).

40. Matoussi H, Mostafa MA. An investigation of Investors Bias on Saudi stock exchange. *International Research Journal of Finance and Economics* 2016; 31: 66-81.

41. Alrubaishi D, Alarifi G. Does family involvement matter in initial public offering underpricing? Evidence from Saudi Arabia. *International Journal of Management, Economics Social Sciences* 2019; 8(3): 157–168.

42. Shen J, Griffith J, Najand M, Sun L. Predicting stock and bond market returns with emotions: Evidence from futures markets. *Journal of Behavioral Finance* 2021; 24(3): 333–344.

43. Hasan MSB, Kumar A, Taffler R. Investor emotions and the cross-section of stock returns. Available online: https://www.efmaefm.org/0EFMAMEETINGS/EFMA%20ANNUAL%20MEETINGS/2021-Leeds/papers/EFMA%202020_stage-1301_question-Full%20Paper_id-417.pdf (accessed on 2 August 2023).Duxbury D, Gärling T, Gamble A, Klass V. How emotions influence behavior in financial markets: A conceptual analysis and emotion-based account of buy-sell preferences. *The European Journal of Finance* 2020; 26(14): 1417–1438.

44. Duxbury D, et al. How emotions influence behavior in financial markets: a conceptual analysis and emotion-based account of buy-sell preferences. *The European Journal of Finance* 2020; 26(14): 1417–1438.

45. Iqbal S, Bilal AR. Investment performance: Emotional beasts are dragging into the darkness of the castle. *Global Business Review* 2021; 2021: 09721509211044309.

46. Pornpikul C, Nettayanun S. Stock return drivers: A mix of reasons and emotions. *Review of Behavioral Finance* 2021; 14(5): 751–771.

47. Chun J, Ahn J, Kim Y, Lee S. Using deep learning to develop a stock price prediction model based on individual investor emotions. *Journal of Behavioral Finance* 2020; 22(4): 480–489.

48. Majewski S, Tarczynski W, Tarczynska-Luniewska M. Measuring investors' emotions using econometric models of trading volume of stock exchange indexes. *Investment Management and Financial Innovations* 2020; 17(3): 281–291.

49. VanderPal GA. Emotional quotient and intelligence quotient on behavioral finance and investment performance. *Journal of Marketing Development Competitiveness* 2021; 15(2).

50. Kaplanski G, Levy H. Investment performance and emotions: An international study. *Studies in Economics Finance* 2019; 36(1): 32–50.

51. Mariappan S, Rani S. Empirical study on business and emotions (market) cycles and sector performance in Indian Stock Market. In: Proceedings of the International Conference on Evidence Based Management 2015; (ICEBM 2015); 20–21 March 2015; Pilani, Rajasthan, India.

52. Willman P. Thinking, feeling and deciding: The influence of emotions on the decision making and performance of traders. *Strategic Direction* 2012; 28(4).

53. Fenton-O'Creevy M, Soane E, Nicholson N, Willman P. Thinking, feeling and deciding: The influence of emotions on the decision making and performance of traders. *Journal of Organizational Behavior* 2011; 32(8): 1044–1061.

54. Ady SU, Tyas AM, Farida I, Gunawan AW. Immediate and expected emotions toward stock returns through overconfidence and cognitive dissonance, the study of Indonesian investor behavior. *PalArch's Journal of Archaeology of Egypt/Egyptology* 2020; 17(3): 1140–1165.

55. Cabrera-Paniagua D, Cubillos C, Vicari R, Urra E. Decision-making system for stock exchange market using artificial emotions. *Expert Systems with Applications* 2015; 42(20): 7070–7083.

56. Zhou Z, Zhao J, Xu K. Can online emotions predict the stock market in China? In: Cellary W, Mokbel M, Wang J (editors). *Web Information Systems Engineering—WISE 2016*, Proceedings of the 17th International Conference on Web Information Systems Engineering (WISE 2016); 7–10 November 2016; Shanghai, China.

57. Cordes H, Nolte S, Schneider JC. Dynamics of stock market developments, financial behavior, and emotions. *Journal of Banking & Finance* 2023; 154: 106711.

58. Almanie T, Aldayel A, Alkanhal G, et al. Saudi Mood: A real-time informative tool for visualizing emotions in Saudi Arabia Using Twitter. In: 2018 21st Saudi Computer Society National Computer Conference (NCC); 25–26 April 2018; Riyadh, Saudi Arabia. pp. 1–6.

59. Alamro R, McCarren A, Al-Rasheed A. Predicting saudi stock market index by incorporating GDELT using multivariate time series modelling. International Conference on Computing, Springer; 2019, pp. 317–328.

60. Akhtar F, Thyagaraj KS, Das N. The impact of social influence on the relationship between personality traits and perceived investment performance of individual investors: Evidence from Indian stock market. International Journal of Managerial Finance 2017.

61. Liang P, Guo S. Social interaction, Internet access and stock market participation—An empirical study in China. *Journal of Comparative Economics* 2015; 43(4): 883–901.

62. Hvide H, Östberg P. Social interaction at work: Co-worker influence on stock investments. Available online: https://www.nccr-finrisk.uzh.ch/media/pdf/SFIResearchDay2013_Oestberg_paper.pdf (accessed on 2 August 2023).

63. Haddad M, Hakim S. Irrational exuberance on the Saudi Stock Exchange. In: Proceedings of the ERF's 15th Annual Conference; 23–25 November 2008; Cairo, Egypot.

64. Wasiuzzaman S. Seasonality in the Saudi Stock Market: The Hajj effect. *The Quarterly Review of Economics Finance* 2018; 67: 273–281.

65. Khan K, Nasir MA, Rossi M. The calendar anomalies on performance and volatility of stock market: The effects of Ramadan on Karachi Stock Exchange. *Global Business Economics Review* 2017; 19(1): 54–69.

66. Keim DB. Size-related anomalies and stock return seasonality: Further empirical evidence. *Journal of Financial Economics* 1983; 12(1): 13–32.

67. Gultekin MN, Gultekin NB. Stock return anomalies and the tests of the APT. *The Journal of Finance* 1987; 42(5): 1213–1224.

68. Hoffman A. Stock return anomalies: Evidence from the Johannesburg Stock Exchange. *Investment Analysts Journal* 2012; 41(75): 21–41.

69. Sehgal S, Subramaniam S, De La Morandiere LP. A search for rational sources of stock return anomalies: Evidence from India. *International Journal of Economics Finance* 2012; 4(4): 121–134.

70. Tangjitprom N. The calendar anomalies of stock return in Thailand. *Journal of Modern Accounting Auditing* 2011; 7(6): 565.

71. Jang J. Stock return anomalies and individual investors in the Korean stock market. *Pacific-Basin Finance Journal* 2017; 46: 141–157.

72. Öztürk MB, Uysal M, Arslan H, et al. The impact of calendar anomalies on stock return and volatility: evidence from Turkish stock market. *Ömer Halisdemir Üniversitesi İktisadi Ve İdari Bilimler Fakültesi Dergisi* 2018; 11(1): 221-238.

73. Anchev S. Investor base and stock return anomalies. Available online: http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1237641&dswid=-2524(accessed on 2 August 2023).

74. Chen T. Stock return anomalies from ending-digit effects around the world. *Global Economic Review* 2017; 46(4): 464–494.

75. Chen Y, Huang W, Jiang GJ. Do short-term institutions exploit stock return anomalies? *Financial Review* 2022; 57: 69–94.

76. Robins RP, Smith GP. Selection bias and pseudo discoveries on the constancy of stock return anomalies. *Review of Quantitative Finance and Accounting* 2020; 55(4): 1407-1426. doi: 10.1007/s11156-020-00878-w.

77. Dong X, Li Y, Rapach D, Zhou G. Anomalies and the expected market return. *The Journal of Finance* 2022; 77(1): 639–681.

78. Wasiuzzaman S. Religious anomalies in Islamic stock markets: The Hajj effect in Saudi Arabia. *Journal of Asset Management* 2017; 18(3): 157–162.

79. Anjum S. Impact of market anomalies on stock exchange: A comparative study of KSE and PSX. *Future Business Journal* 2020; 6(1): 1–11.
80. Bingham CB, Eisenhardt KM. Rational heuristics: The 'simple rules' that strategists learn from process experience. *Strategic Management Journal* 2011; 32(13): 1437–1464.
81. Tversky A, Kahneman D. Judgment under uncertainty: Heuristics and biases. *Science* 1974; 185(4157): 1124–1131.
82. Gigerenzer G, Gaissmaier W. Heuristic decision making. *Annual Review of Psychology* 2011; 62: 451–482.
83. Shah AK, Oppenheimer DM. Heuristics made easy: An effort-reduction framework. *Psychological Bulletin* 2008; 134(2): 207–222.
84. Albar FM, Jetter AJ. Heuristics in decision making. In: PICMET'09-2009 Portland International Conference On Management Of Engineering & Technology; 2-6 August 2009; Portland, OR, USA. pp. 578–584.
85. Doswell III CA. Weather forecasting by humans—Heuristics and decision making. *Weather and Forecasting* 2004; 19(6): 1115–1126.
86. Lau RR, Redlawsk DP. Advantages and disadvantages of cognitive heuristics in political decision making. *American Journal of Political Science* 2001; 45(4): 951–971.
87. Busenitz LW, Barney JB. Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. *Journal of Business Venturing* 1997; 12(1): 9–30.
88. Pompian MM, Wood AS. *Behavioral Finance and Wealth Management: How to Build Optimal Portfolios for Private Clients*. John Wiley and Sons, Inc; 2006.
89. Ahmad M, Shah SZA. Overconfidence heuristic-driven bias in investment decision-making and performance: Mediating effects of risk perception and moderating effects of financial literacy. *Journal of Economic and Administrative Sciences* 2020; 38(1): 60–90.
90. Chernoff E, Sriraman B. Probabilistic thinking. *AMC* 2014; 10: 12.
91. Simon M, Houghton SM, Aquino K. Cognitive biases, risk perception, and venture formation: How individuals decide to start companies. *Journal of Business Venturing* 2000; 15(2): 113–134.
92. Barber BM, Odean T. The behavior of individual investors. *Handbook of the Economics of Finance* 2013; 2(Part B): 1533-1570.
93. Moore DA, Healy PJ. The trouble with overconfidence. *Psychological Review* 2008; 115(2): 502–517.
94. Odean T. Do investors trade too much. *American Economic Review* 1999; 89(5): 1279-1298. doi: 10.1257/aer.89.5.1279
95. Tversky A, Kahneman D. Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk Uncertainty* 1992; 5(4): 297–323.
96. Barberis N, Jin LJ, Wang B. Prospect theory and stock market anomalies. In: Proceedings of the 10th Miami Behavioral Finance Conference; 13 December 2019; Coral Gables, FL, USA.
97. Chien CC, Chen TC. Can the January anomaly in Taiwan's stock market be explained by the prospect theory? *Quantitative Finance* 2008; 8(4): 335–339.
98. He XD, Zhou XY. Portfolio choice under cumulative prospect theory: An analytical treatment. *Management Science* 2011; 57(2): 315–331.
99. Bhootra A, Hur J. High idiosyncratic volatility and low returns: A prospect theory explanation. *Financial Management* 2014; 44(2): 295–322.
100. Zafar Z, Siddiqui DA. Behavioral finance perspectives on Pakistan stock market efficiency: Assessing the prospect theory empirically with an adaptive pattern of efficiency across military and democratic regimes. *International Journal of Organizational Leadership* 2020; 9(1): 20–38.
101. Barberis N, Huang M, Santos T. Prospect theory and asset prices. *The Quarterly Journal of Economics* 2001; 116(1): 1–53.
102. Zhong X, Wang J. Prospect theory and corporate bond returns: An empirical study. *Journal of Empirical Finance* 2018; 47: 25–48.
103. Hirshleifer D, Shumway T. Good day sunshine: Stock returns and the weather. *The Journal of Finance* 2003; 58(3): 1009–1032.
104. Loewenstein, G.F. et al. (2001) Risk as feelings. chological bulletin 127 (2), 267.
105. van Dolen WM, de Ruyter K, Streukens S. The effect of humor in electronic service encounters. *Journal of Economic Psychology* 2008; 29(2): 160–179.
106. Shiller RJ. Human behavior and the efficiency of the financial system. *Handbook of Macroeconomics* 1999; 1: 1305-1340.
107. Nofsinger JR. *The Psychology of Investing*. Routledge; 2017.
108. Olsen RA. Behavioral finance and its implications for stock-price volatility. *Financial Analysts Journal* 1998; 54(2): 10-18. doi: 10.2469/faj.v54.n2.2161
109. De Long JB, Shleifer A, Summers LH, Waldmann R. Positive feedback investment strategies and destabilizing rational speculation. *The Journal of Finance* 1990; 45(2): 379–395.

110. Edmans A, Garcia D, Norli Ø. Sports sentiment and stock returns. *The Journal of Finance* 2007; 62(4): 1967–1998.

111. Brock WA, Durlauf SN. Multinomial choice with social interactions. *National Bureau of Economic Research* 2003. doi: 10.3386/t0288

112. Hong H, Kubik JD, Stein JC. Social interaction and stock-market participation. *The Journal of Finance* 2004; 59(1): 137–163.

113. Copur Z. *Handbook of research on behavioral finance and investment strategies: Decision making in the financial industry: Decision Making in the Financial Industry*. IGI Global; 2015.

114. Latif M, Arshad S, Fatima M, et al. Market efficiency, market anomalies, causes, evidences, and some behavioral aspects of market anomalies. *Research Journal of Finance and Accounting* 2011; 2(9): 1-13.

115. del Águila N. Behavioral finance: Learning from market anomalies and psychological factors. *Revista de Instituciones, Ideas y Mercados* 2009; 50: 47–104.

116. Yalçın KC. Market rationality: Efficient market hypothesis versus market anomalies. *European Journal of Economic Political Studies* 2010; 3(2): 23–38.

117. Chan KF, Gray P, Gray S, Zhong A. Political uncertainty, market anomalies and presidential honeymoons. *Journal of Banking & Finance* 2020; 113: 105749.

118. Patton AJ, Weller BM. What you see is not what you get: The costs of trading market anomalies. *Journal of Financial Economics* 2020; 137(2): 515–549.

119. Salman M, Khan B, Khan SZ, et al. The impact of heuristic availability bias on investment decision-making: Moderated mediation model. *Business Strategy & Development* 2021; 4(3): 246-257. doi: 10.1002/bsd2.148

120. Ahmad M, Shah SZA. Overconfidence heuristic-driven bias in investment decision-making and performance: Mediating effects of risk perception and moderating effects of financial literacy. *Journal of Economic and Administrative Sciences* 2020; 38(1): 60–90.

121. Mahmood Z, Kouser R, Abbas SS, Saba I. The effect of hueristics, prospect and herding factors on investment performance. *Pakistan Journal of Social Sciences* 2016; 36(1): 475–484.

122. Kesebir P, Gasiorowska A, Goldman R, et al. Emotional Style Questionnaire: A multidimensional measure of healthy emotionality. *Psychological Assessment* 2019; 31(10): 1234-1246. doi: 10.1037/pas0000745

123. Yang M, Mamun AA, Mohiuddin M, et al. Predicting stock market investment intention and behavior among Malaysian working adults using partial least squares structural equation modeling. *Mathematics* 2021; 9(8): 873. doi: 10.3390/math9080873

124. Phuoc Luong L, Thi Thu Ha D. Behavioral factors influencing individual investors decision-making and performance.: A survey at the Ho Chi Minh Stock Exchange. *Asian Journal of Finance & Accounting* 2011; 6(1).

125. Waweru NM, Munyoki E, Uliana E. The effects of behavioural factors in investment decision-making: a survey of institutional investors operating at the Nairobi Stock Exchange. *International Journal of Business and Emerging Markets* 2008; 1(1): 24-41. doi: 10.1504/IJBEM.2008.019243

126. Krejcie RV, Morgan DW. Determining sample size for research activities. *Educational Psychological Measurement* 1970; 30(3): 607–610.

127. Yao Y, Wang P, Jiang Y, et al. Innovative online learning strategies for the successful construction of student self-awareness during the COVID-19 pandemic: Merging TAM with TPB. *Journal of Innovation & Knowledge* 2022; 7(4): 100252. doi: 10.1016/j.jik.2022.100252

128. Jiang Y, Liu H, Yao Y, Li Q, Li Y. The positive effects of growth mindset on students' intention toward self-regulated learning during the COVID-19 pandemic: A PLS-SEM approach. *Sustainability* 2023; 15(3): 2180. doi: 10.3390/su15032180

129. Li Q, Zeng J, Zhao B, et al. Nurses' preparedness, opinions, barriers, and facilitators in responding to intimate partner violence: A mixed-methods study. *Journal of Nursing Scholarship* 2023. doi: 10.1111/jnu.12929

130. Purwanto A. Education research quantitative analysis for little respondents: comparing of Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS. *Jurnal Studi Guru Dan Pembelajaran* 2021; 4(2).

131. Rouf MA, Akhtaruddin M. Factors affecting the voluntary disclosure: A study by using Smart PLS-SEM approach. *International Journal of Law Management* 2018; 60(6): 1498–1508

132. Thaker HMT, Sakaran KC, Nanairan NM, et al. Drivers of loyalty among non-Muslims towards Islamic banking in Malaysia: Evidence from SmartPLS. *International Journal of Islamic Middle Eastern Finance Management* 2020; 13(2): 281–302.

133. Kalkbrenner MT. Alpha, omega, and H internal consistency reliability estimates: Reviewing these options and when to use them. *Counseling Outcome Research Evaluation* 2021; 14(1): 77–88.

134. Le HTD, Bui MT, Nguyen GTC. Factors affecting electronic tax compliance of small and medium enterprises in Vietnam. *The Journal of Asian Finance, Economics Business* 2021; 8(1): 823–832.

135. Tomaro QPV, Genon LJ, Amod AF. Singled out: Invisibilization of single mothers in social welfare and protection policies. *Jurnal Studi Pemerintahan* 2021; 12(2): 132–155.

136. Abd Rahman NAAH, Ridhauddin M, Shahri INM, Hamid H. The study of green human resource management practices within the private and public sector. *Asian Journal of Research in Business Management* 2022; 4(2): 170–178.

137. Netemeyer RG, Bearden WO, Sharma S. *Scaling procedures: Issues and applications*. SAGE Publications; 2003.

138. Kumar R, Singh H. The Relationship Between Performance Measures and Overall Performance in the Manufacturing Environment. In: Khosrow-Pour DBA (editors). *Encyclopedia of Organizational Knowledge, Administration, and Technology*. IGI Global; 2021, pp. 341-354.

139. dos Santos PM, Cirillo MÂ. Construction of the average variance extracted index for construct validation in structural equation models with adaptive regressions. *Communications in Statistics-Simulation Computation* 2021; 52(4): 1639–1650.

140. Pervan M, Curak M, Pavic Kramaric T. The influence of industry characteristics and dynamic capabilities on firms' profitability. *International Journal of Financial Studies* 2017; 6(1): 4.

141. Hilkenmeier F, Bohndick C, Bohndick T, et al. Assessing distinctiveness in multidimensional instruments without access to raw data-a manifest Fornell-Larcker criterion. *Frontiers in Psychology* 2020; 11: 223. doi: 10.3389/fpsyg.2020.00223

142. Ab Hamid M, Sami W, Sidek MM. Discriminant validity assessment: Use of Fornell & Larcker criterion versus HTMT criterion. *Journal of Physics: Conference Series* 2017; 890(1): 012163. doi: 10.1088/1742-6596/890/1/012163

143. Afthanorhan A, Ghazali PL, Rashid N. Discriminant validity: A comparison of CBSEM and consistent PLS using Fornell & Larcker and HTMT approaches. *Journal of Physics: Conference Series* 2021; 1874(1): 012085. doi: 10.1088/1742-6596/1874/1/012085

144. Henseler J, Ringle CM, Sarstedt M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science* 2014; 43(1): 115–135.

145. Hair JF, Sarstedt M, Hopkins L, Kuppelwieser VG. Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review* 2014; 26(2): 106–121.

146. Hair JF, Ringle CM, Sarstedt M. PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory Practice* 2011; 19(2): 139–152