Overconfidence Bias, Self-attribution Bias and Investor Decisions: Moderating Role of Information Acquisition

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Abstract

The purpose of this paper is to empirically test the association of behavioral biases like overconfidence bias and self-attribution bias, and information acquisition with individual investors decisions. This study also extends its contributions in understanding the role of information acquisition in moderating the relationship of behavioral biases with investors decisions. SmartPLS 3.0 is used to analyze the structural equation model which is applied on the cross-sectional data collected from 390 individual investors of Pakistan Stock Exchange using cluster sampling technique. Findings of this study confirm that behavioral biases (overconfidence bias and self-attribution bias) distort the rationality of individual investors' decision, and information acquisition significantly moderates the relationship of overconfidence bias with investor decisions. This study contributes to the existing behavioral finance literature by unleashing less attended potential of information acquisition in managing irrationality caused by overconfidence bias. Individual investors can use this study to better understand the adverse impact of behavioral biases as well as the usefulness of information acquisition in handling the irrationality resulted from overconfidence bias. The fruits of this study can be extended to the policy makers so that they can better steer their policies concerning the provision of information to the individual investors. Authors attempt to combine the literature of behavioral finance and information acquisition with a notion to extend new theoretical understandings relating to investor decisions.

Keywords: overconfidence bias, self-attribution bias, information acquisition, investor decision, behavioral biases, efficient market hypothesis.

1. Introduction

Investment in stock market is considered a risky venture which has the potential to generate higher returns as compared to other avenues of investment. In this context, traditional finance (for example, Markowitz, 1952; Fama, 1970) necessitate investors to make rational investment decisions. Mushinada and Veluri (2019) asserted that rational decisions require infinite decision time, information and cognitive ability which is steered towards achieving an optimal solution to the problem. However, Simon (1957) criticize the impractical assumption of perfect rationality and coined the concept of bounded rationality which incorporated the limitations of decision time and human reasoning abilities to achieve satisfactory solution instead of an optimal one. It has started a new debate in finance literature and pivotal contribution of Tversky and Kahneman (1974) addressed the behavioral aspects of individuals, affecting their judgment under uncertainty. Later, prospect theory was introduced by Kahneman and Tversky (1979) which documented that individual investors deviate from rationality owing to psychological biases which in fact drive their decisions. This discovery has attracted the interest of academic scholars and numerous behavioral biases have been empirically tested. For example, Mumtaz Ahmad, Hassan, Mahmood and Aslam (2016) documented that investor personality traits are associated with investment behavior. Similarly, Jain et al. (2019) tested the relationship of herding bias, loss aversion bias and overconfidence bias with investor decisions in India. Likewise, Rahman (2019) documented the link of behavioral factors with financial risk tolerance of investors.

Although, numerous behavioral biases which have been addressed in the literature which are associated with investors decisions but, two prominent biases are taken in this study owing to their stiff association with investor rationality. These biases include overconfidence bias and self-attribution bias. DeBondt and Thaler (1994) revealed that the most vigorous element which affect the judgment of individual, is the overconfidence bias. In overconfidence bias, individuals overestimate their skills and underestimate the risk associated with the securities. Studies documented that there is an adverse impact of overconfidence bias with forecasting accuracy Michailova et al. (2017) and investment decisions (Shah, Ahmad, & Mahmood, 2018) of individual investors. Moreover, the consequences of this bias are not limited to distortion of investor decisions, rather a market bubble may be resulted in response to overconfidence of investors (Merkle & Weber, 2009) and such a vulnerability concealed in this construct make it more prominent among other biases. Moreover, beside overestimating own skills and underestimating the risk, victim of self-attribution bias takes credit of good performance and blame external factors if portfolio returns are not satisfactory (Alrabadi et al., 2018; Mushinada & Veluri, 2018). Although it was initially documented that individuals do not learn from their dreadful decisions either because they forget their mistakes or they are ignorant of previously committed errors while making crucial decisions (Nguyen & Schuessler, 2012; Hoffmann & Post, 2014). Subsequently, it was discovered that it is self-attribution bias which refrain investors to learn from their mistakes owing to the misperception that their losses and failures are caused by external factors (Kansal & Singh, 2018). Moreover, self-attribution bias not only

compels an investor to overreact while making investment (Mittal, 2010) but also it is positively connected with investment volume (Mahina et al., 2018). Since, failure to identify and overcome discrepancies in previous decisions, is not compatible with rationality concept as it requires effective evaluation of previous decisions (Hammond et al., 2002), thus making self-attribution bias relevant in this study. Moreover, overconfidence bias and self-attribution bias remain under discussion among behavioral finance scholars (for example, Russo & Schoemaker, 1992; Ali et al., 2016; Costa et al., 2017; Mallik et al., 2017; Kansal & Singh, 2018; Mushinada & Veluri, 2018; Qasim et al., 2019).

Implications of previous studies concerning overall biases in general whereas overconfidence and self-attribution in specific, confirmed that behavioral biases adversely affect the rationality of investors while making investment decisions and risk preferences. Thus, there is a dire need to address this behavioral phenomenon because portfolios of behaviorally motivated investors carry idiosyncratic risk owing to inadequate diversification (Goetzmann & Kumar, 2008) which in turn impair their financial wellbeing and portfolio performance (Hoffmann & Post, 2014). Although, plenty of research was previously conducted in enumerating the impact of behavioral biases on decision making of investors, however, literature is scarce in illumination those factors which can reduce or overcome these biases. While few studies have recorded interaction effect in existing framework of investor decisions, but these efforts were restricted to demographic variables and few cognitive constructs. For example, Katper et al. (2019) studied the potential of investor education, occupation and marital status to moderate the relationship of behavioral biases with investment decisions. Similarly, Sabir et al. (2019) documented that financial literacy moderates the relationship of psychological factors with herding behavior of investors. Likewise, Rasheed et al. (2018) recorded moderating role of locus of control on the relationship of availability bias and representative bias with investment decision. Despite the efforts of contemporary scholars in incorporating moderating variables to the existing models, still those constructs were not sufficiently addressed which carry logical justification to reduce or overcome the irrationality caused by behavioral biases. Because investors indulge in behavioral biases owing to the uncertainty of decisions (Simon, 1990), therefore, it is pertinent to consider that uncertainty can be reduced with better information acquisition (Lachlan et al., 2009). Information acquisition entails the methods, procedures and sources employed by the investors for making investment decisions and is pivotal in making rational decision as highlighted by numerous empirical evidences. Massa and Simonov (2006) confirmed that quality information not only leads to adjust the payoff generated from the portfolio, but also it is helpful in reducing the biased behavior of investors. Similarly, it is documented that the degree to which a person is likely to exhibit behavioral biases is connected with the pattern of information reception and comprehension while making investment decisions (Mittal, 2010). Moreover, studies also confirmed that those investors who spend much time and efforts for acquiring information, are more prone to incorporate risky assets in their portfolios as well as, information acquisition also helps to refine the estimation (Taylor & Wozniak, 2018). Likewise, Sabir et al. (2018) suggested that access and utilization of better information has potential to

reduce the irrationality exhibited by individual investors while making investment decision. In view of the irrationality caused by overconfidence and self-attribution of investors, our study therefore, allows us to explore the potential of information acquisition in reducing these biases. It is pertinent to address this issue because de-biasing will enable individual investors to adequately diversify their portfolio by removing idiosyncratic risk and earn better returns. Moreover, rational investor behavior will improve long term economic growth of a country (Kavussanos & Dockery, 2001) and better allocation of resources (Mookerjee & Yu, 1999).

Furthermore, it is documented that less financially literate individuals are more vulnerable to behavioral biases (Fernández et al., 2011), therefore, our study enables us to collect data from Pakistan which has the lowest level of financial literacy in relation to developed as well as developing countries in neighboring region (Visa, 2012). Besides, National Clearing Company of Pakistan documented that around 250,000 individual investors of Pakistan Stock Exchange (PSX) represent the largest gross buyer in Local Investor Portfolio Investment (LIPI). Therefore, this study is envisioned to collect data from individual investors of PSX which not only lack sufficient financial knowledge but also are in significant proportion among other participants of stock market.

Moreover, it is argued that behavioral biases are categorized as heuristics which are employed by investors to reduce the chances of loss in risky situation (Shah et al., 2018), therefore, heuristics theory is supporting the research phenomenon under investigation in this study. Whenever decision makers confront with uncertainty, heuristics came into action to simplify the task (Ritter, 2003) and reduce complexity while computing probabilities to simplify the judgement (Tversky & Kahneman, 1974). Although, heuristics are helpful whenever sufficient time is not available for decision making (Waweru, Munyoki, & Uliana, 2008) but they often lead to systematic deviations from rationality (Tversky & Kahneman, 1974). Thus, these findings make heuristics theory more relevant in the context of present study.

2. Literature Review

This section presents the review of literature along with the hypothesis which are developed at the end of each sub-section. First sub-section describes the literary evidence concerning overconfidence bias and investor decisions which is followed by next sub-section relating to self-attribution bias and investor decisions. Last sub-section is related to the information acquisition as a moderating variable.

2.1 Overconfidence Bias and Investor Decisions

Overconfidence bias is one of the important constructs which affect the judgment of individuals and it lead them to overestimate their competencies and the likelihood to succeed in the market (De Bondt & Thaler, 1995). Extant literature confirmed the presence of overconfidence bias among the individual investors trading in the market, which compel them not only to underestimate the downside risk associated with the securities but also keep their portfolio undiversified (Mushinada & Veluri, 2018; Baker et al., 2019).

Likewise, Goetzmann and Kumar (2008) confirmed that portfolios of overconfident investors carry idiosyncratic risk owing to inadequate diversification. Although, multiple studies reinforce that overconfident investors demonstrate excessive trading behavior (Odean, 1998; Glaser & Weber, 2007) but this understanding was further explained by Barber and Odean (2001) which confirmed that male overconfident investors trade more aggressively than female investors thus, resulting in lower returns. On the contrary, recent empirical evidence suggested that excessive trading frequency of female investors, paired with overconfident bias, is resulting in losses (Michailova et al., 2017). Theses contradictory findings require further investigation into this phenomenon. Besides, Dittrich, Güth and MacIejovsky (2005) opined that overconfidence behavior is positively associated with the complexity of the task. Similarly, the decision making of active players in the market is more likely to be affected by the overconfidence bias (Masood et al., 2010). Moreover, it is also established that an increase in an overconfidence bias is likely to be associated with forecasting error which is connected with losses (Michailova et al., 2017). Furthermore, evidence from emerging market also reflected that investor trading mistakes are also resulted due to overconfidence bias (Chen et al., 2007). Although findings based on online investors from Indonesia revealed that overconfidence bias is not associated investors decisions (Fachrudin et al., 2017), however, various studies confirmed the association of overconfidence bias with investor decisions. For example Rizwan et al. (2018) opined that overconfidence is positively associated with investor decision. Additionally, Shah et al. (2018) found negative association of overconfidence bias investor decisions. Similarly, Bashir et al. (2013) confirmed that there is an impact of overconfidence bias on investor decisions. Furthermore, Kafayat (2014) argued that there is negative relationship of overconfidence bias with investor decisions.

After reviewing the relevant literature, it is extracted that overconfidence bias is not only associated with trading mistakes, forecasting errors, portfolio losses, inadequate diversification but also it has relationship with investor decisions making. Therefore, in view of the above evidence, the following hypothesis is postulated:

➢ **H₁:** there is a significant relationship of overconfidence bias with investor decisions.

2.2 Self-attribution Bias and Investor Decision

Self-attribution bias is very important concept in the domain of psychology and it refers to a person likelihood to take credit of successes and attribute failures to those factor which are beyond ones control (Feather & Simon, 1971; Miller & Ross, 1975). Although, self-attribution bias is now gaining attention in the domain of individual financial decisions but extant literature lacks sufficient studies which empirically tested this construct (Hoffmann & Post, 2014). However, few empirical evidence confirmed the presence and association of self-attribution bias with investor decisions. For example, Feng and Seasholes (2005) findings based on 1,511 investors accounts from China reported the associated of self-attribution with disposition effect which entails that sufferer of self-attribution bias sell profit generating stock whereas hold loss making shares. Moreover, impact of self-attribution bias is not restricted to individual investors decisions rather, it is also documented that this attribution impair the financial decisions of corporate treasures of

Australia (Ramiah et al., 2016). On the other hand, an individual's profession is also predicts the demonstration of self-attribution behavior. Mittal (2010) findings from India reflected that businessman is more expose to self-attribution bias as compared to salaries individuals. Furthermore, Nguyen and Schuessler (2012) interviewed 890 investors trading in Germany and found that self-attribution bias become more vulnerable in bullish market. Moreover, the demonstration of self-attribution bias increased if an investor is new in the market and besides increase in education also flare up this bias (Mishra & Metilda, 2015). Furthermore, Mahina et al. (2018) suggested that there is a dire need to seriously consider self-attribution bias if rational decision making is desired.

Despite the limited empirical evidence concerning self-attribution bias from developing and developed economies, it is established that self-attribution bias compels an investor to sell profit making stocks and hold the loss generating shares. Besides, it is further confirmed that the financial decisions of individuals and corporate treasures are impaired due to presence of self-attribution bias. Therefore, the following hypothesis is postulated:
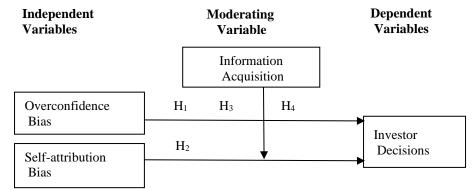
➢ **H₂:** there is a significant relationship of self-attribution bias with investor decisions.

2.3 Moderating Role of Information Acquisition on the Relationship of Behavioral Bias and Investor Decisions

Information acquisition comprises of methods, techniques and sources employed by an investor to collect required information for investment decisions. Better method and sources of information have an impact in making rational decision. For example, Taylor and Wozniak (2018) explained that better information acquisition is helpful in reducing the ambiguity which may be confronted by an investor while making investment decision. Similarly, if an investor employs poor sources of information, it may lead to substandard decision whereas, use of quality information not only helpful in adjusting the expected payoff but also reduce the biased behavior of investor (Massa & Simonov, 2006). In similar fashion, Mittal (2010) argued that the demonstration of biased behavior is contingent on the way people receive and observe investment related information. Furthermore, Kramer (2012) confirmed that the portfolios of well-informed investors carry less risk and are well diversified. Moreover, Waqar, Zaheer, Raza and Kanwal (2017) concluded that provision of quality information to the investor is not only helpful in raising investor confidence, but also positively contribute towards investor satisfaction. Furthermore, it is confirmed that information acquisition activity may enable investors to incorporate stock related fundamentals along with other facts, which will consequently improve their rationality while making investment decisions (Kong, Lin, & Liu, 2020). Despite the above empirical evidence which highlight the importance of information acquisition in improving decision quality, behavioral finance literature still lacks sufficient attention in examining this construct. Although, it is established that an individual gender predicts information search behavior (Loibl & Hira, 2011) and investor personality mediates the relationship of information acquisition and trading behavior (Tauni *et al.*, 2017), however, extant literature is scarce in documenting the potential of information acquisition in the framework of behavioral biases and investors decisions. This study attempts to fill this knowledge gap

by incorporating information acquisition as moderating variable in the relationship of overconfidence bias and self-attribution bias with investor decisions. Therefore, the following hypothesis is postulated:

> **H3:** information acquisition moderates the relationship of overconfidence bias and investor decisions.

> **H4:** information acquisition moderates the relationship of self-attribution bias and investor decisions.

Independent Variables   **Moderating Variable**   **Dependent Variables**

Information Acquisition

Overconfidence Bias   H1   H3   H4   Investor Decisions

H2

Self-attribution Bias

2.4 Research Model

Research model of this study is presented in Figure 1 which expressed the variables of the study along with the proposed hypothesis. Overconfidence bias and self-attribution bias are independent variables, whereas investor decisions and information acquisition are dependent and moderating variables, respectively.

3. Research Methodology

This paper investigates the moderating role of information acquisition on the relationship of overconfidence bias and self-attribution bias with investor decisions. For this purpose, cross sectional data is collected by using survey questionnaires from individual investors trading in Pakistan stock exchange.

3.1 Data Collection and Sampling

The population of this study is the individual investors trading in Pakistan Stock Exchange (PSX), which consist of the individual investors of PSX trade securities online and on the floor of exchange, which are located in Lahore, Islamabad and Karachi. PSX's former CEO, Richard Morin gave an interview to Pakistan Today in 2018 which revealed that the population of individual investors in Pakistan is around 250,000.

Sample is the part of population and represents its characteristics. It is very crucial step is research methodology because it enables the researcher to draw inference about the population parameters on the basis of sample statistics (Bhattacherjee, 2012). Therefore, this study collected data from all three floors of PSX which are in Lahore, Islamabad and

Karachi. To determine the required sample size for a population of around 250,000 individual investors in Pakistan, Krejcie and Morgan (1970) suggested a sample consist of 384 observations. Moreover, it is also observed that survey response rate in Pakistan and India is found to be around 52.68% (Mellahi & Harris, 2016), therefore, double number of questionnaires were floated. In this way, a total of 768 questionnaires were distributed among individual investors of Pakistan and out of which 405 questionnaires were returned. After initial screening, 15 questionnaires were found incomplete which resulted in 390 useable questionnaires for data analysis. Out of 390 useable questionnaires, 142 (36.39%) were from Karachi, 122 (31.39%) from Islamabad and remaining 126 (32.22%) were from Lahore. This study employed cluster sampling. The rationale to use this technique is the existence of three floors of PSX which are considered as cluster and all three clusters are used for better representation of population.

3.2 Instrumentation for Data Collection

First part of the questionnaire comprised of demographic information of individual investors followed by items pertaining to behavioral biases, investor decisions and information acquisition. Eminent literature documented the utilization of multiple sources for the measurement of each construct (Raut, Das, & Mishra, 2018) therefore, this study also employed more than one source for enumerating each latent variable. The questionnaire was designed on five-point Likert scale for the variables of this study. Individual investors were asked to respond using five-point Likert scale starting from 1 (strongly disagree) to 5 (strongly agree). Table 1 expresses the sources of adapted items along with the construct name and number of items.

Table 1: **Summary of Variables and Total Number of Items**

Variable	Number of items	Sources
Overconfidence bias	9 items	Waweru, Munyoki and Uliana (2008), Abdallah & Hilu (2015), Mishra and Metilda (2015), Raut, Das and Mishra (2018), Mushinada and Veluri (2019),
Self-attribution bias	8 items	Greenberg, Pyszczynski and Solomon, (1982), Mishra and Metilda (2015), Mushinada and Veluri (2019)
Information acquisition	7 items	Loibl and Hira (2011), Abreu and Mendes (2012), Kramer (2016), Shin, Kim and Seay (2020)
Investor decision	10 items	Pasewark and Riley (2010), Mushinada and Veluri (2019)

Eminent literature documented multiple characteristics of overconfidence bias, self-attribution bias, information acquisition and investor decisions, which guided this study to

adapt items to measure these constructs. For example, an overconfident investor: (i) believes that his skills are better than others (Montier, 2002), (ii) has unjustified faith in his intuitive reasoning and abilities (Pompian, 2011), and (iii) his trading frequency is very much accelerated (Barber & Odean, 2001). To address these characteristics, nine items were adapted from Waweru et al. (2008), Abdallah and Hilu (2015), Mishra and Metilda (2015), Raut et al. (2018) and Mushinada & Veluri, 2019).

Similarly, self-attribution bias is a psychological bias which compel an investor to take credit of good portfolio performance and blame external factors if the situation is different from expectation (Bradley, 1978). Moreover, the attention of individual investor suffer from self-attribution bias is restricted towards limited factors (Sharma & Shakeel, 2015). Keeping in view the above insights about self-attribution bias, eight items were adapted from previous studies. Seven items adapted from Greenberg et al. (1982), Mishra and Metilda (2015), Mushinada and Veluri (2019), were related to the behavior of investor for taking credit of good performance and blaming external factors for adverse performance. One item was adapted from Mishra and Metilda (2015) to capture limited attention of investor.

Moreover, information acquisition comprises of tendency, frequency and inclination of investor towards obtaining investment related information. For example, acquiring information from trusted sources not only help investor to timely balance the portfolio (Epstein & Schneider, 2008) but also, rapid information gathering enable investor to trade frequently in stocks (Abreu & Mendes, 2012). Moreover, financial advice from experts assists investors in achieving financial satisfaction as well as it reduces financial stress of the investors (Loibl & Hira, 2011). Four items adapted from Loibl and Hira (2011), Abreu and Mendes (2012), and Shin et al. (2020) were related to portfolio balancing and trading frequency whereas, three items adapted from Loibl and Hira (2011), Abreu and Mendes (2012), and Kramer (2016) addressed the financial advice for making decisions.

Furthermore, extant literature confirms that behavioral biases adversely affect the rational decision making of investor. Investor decisions are said to be rational if it involve systematic decision making process (Robbins & Judge, 2005) to make an informed and safe investment decision. Additionally, rational decisions maker go through rigorous information search (Mintzberg, Raisinghani, & Theoret, 1976) as well as his decision resulted in an increase in the expected profit and reduction in the risk of portfolio (Reilly & Brown, 2011). In this context, four items adapted from Pasewark and Riley (2010) and one item adapted from Mushinada and Veluri (2019) were related with profit maximization and risk reduction. Likewise, five items adapted from Mushinada and Veluri (2019) were targeted on relevant information search for rational decision making.

3.3 Methodology

Collected data were processed and analyzed using two software: (i) Statistical Package for Social Sciences (SPSS), which was employed for data screening, respondents' demographic analysis as well as getting data ready for inferential analysis; and (ii) SmartPLS software was used for Partial Least Square Structural Equation Modelling (PLS-SEM) which substantially expressed the relationships of underlying variables of the study. PLS-SEM enables the researcher to simultaneously evaluate the factor loading as well as

the results of proposed hypothesis with certain probabilities. Moreover, the rational to use PLS-SEM instead of Covariance Based Structural Equation Modelling (CB-SEM) is inherent in the distributional assumption which is usually found non-normal in social sciences (Hair, Risher, Sarstedt, & Ringle, 2019). Furthermore, in case of absence of normality assumption, CB-SEM require very much large sample size to generate robust results, otherwise it can produce unusual results (Reinartz, Haenlein, & Henseler, 2009). Although, it is believed that SmartPLS has the potential to work with small sample size (Hair et al., 2019) however, Hair, Hult, Ringle and Sarstedt (2016) suggested that "minimum sample size should be 10 times the maximum arrowheads pointing at a latent variable". Therefore, sample size used in this study is compatible with SmartPLS.

Before going for data collection, Churchill (1979) has suggested that the questionnaire must go through the process of face validity. Face validity reflects the extent to which an items belongs to the construct (Nunnally & Bernstein, 1994). For this purpose, industry and academic experts were requested to scrutinize the questionnaire and assess its face validity. Experts' suggestions were received and duly incorporated in the final questionnaire before disbursement for pilot test.

4. Data Analysis and Results

Data analysis section comprised of five subsections. The first sub-section presents the results of pilot test which is followed by sub-section two concerning descriptive profile of the respondents for the entire collected responses (N = 390). Sub-section three portrays the assessment of measurement model which deals with the factor loadings, reliability and validity of the constructs. Sub-section displays the results of structural model and in the last sub-section, moderation analysis is discussed.

4.1 Pilot Test

Since this study has adapted items from multiple sources, hence, it is pertinent to conduct pilot test for further validation of adapted instruments. For this purpose, 80 questionnaires were distributed among individual investors of PSX, and 52 filled questionnaires were returned and out of which 46 survey forms were complete from analysis perspective. The effective response rate (57.5%) was in line with the survey response received in social sciences (Mellahi & Harris, 2016). The prime outcome of pilot test was reflected in term of internal consistency with the help of Cronbach Alpha as suggested by Nunnally (1978). The minimum acceptable value of Cronbach alpha is 0.70 as recommended by Nunnally (1978). Table 2 depicted the Cronbach alpha of the latent constructs used in the study:

Table 2: **Reliability Analysis of Pilot Data of Pilot Test**

Latent Variables	Cronbach's Alpha
Overconfidence Bias (OB)	0.901
Self-attribution Bias (SA)	0.911
Information Acquisition (IA)	0.894
Investor Decisions (ID)	0.919

Table 2 shows reliability analysis of pilot test and it reflects that Cronbach alpha is in between 0.894 to 0.919 which is above the minimum benchmark of 0.70.

4.2 Descriptive Profile of the Respondents

Presentation of demographic characteristics of the respondents is important before conducting inferential analysis of the variables. Table 3 summarized the descriptive profile of the survey respondents. It shows that the proportion of male respondents is 86.94% whereas female respondents represent 13.06% of the total sample. So far as the age of investor is concerned, significant proportion fall in the age group of 36 years to 55 years. Education level of investors reveals that 48.89% respondents hold bachelor's degree and 36.11% respondents' qualification is masters. About 6.94% investors' experience is less than one year whereas, cumulative percentage of investors having experience from five years to beyond ten years is 67.22% (31.94% + 35.28%). Neither investor is solely invested in the international stocks, rather 11% investors have both national and international investment exposure and remaining 89% only invest in local stock which have been traded in Pakistan Stock Exchange. Most of the individual investor of Pakistan are married (83.89%) as well as 57.50% of the investors carry stock trading besides their own businesses. Although, there is a viable proportion (61.94%) of investors which have finance related background but, there are 38.06% investors which belong to the other occupational background.

Table 3: Demographic Profile of Respondents

Category	Sub-category	Frequency	Percentage (%)
Gender	Male	339	86.94%
	Female	51	13.06%
Age (Years)	Up to 25	22	5.56%
	26 to 35	70	18.06%
	36 to 45	153	39.17%
	46 to 55	93	23.89%
	Above 56	52	13.32%
Highest Level of Education	Matriculation or below	9	2.22%
	Intermediate	43	11.11%
	Bachelors	191	48.89%
	Masters	141	36.11%
	PhD	0	0.00%
	Others	7	1.67%
Monthly Income	Below Rs. 50,000	51	13.06%
	Rs.50,001-100,000	164	41.94%
	Rs.100,001-150,000	109	28.06%
	Above Rs.150,000	66	16.94%
Investment Experience	Less than one year	27	6.94%
	One to five years	101	25.83%
	Five to ten years	125	31.94%
	More than ten years	138	35.28%
Portfolio Exposure	Local stocks	347	88.89%
	International stock	0	0.00%
	Both local and international	43	11%
Marital Status	Single	36	9.17%
	Married	327	83.89%
	Divorced	27	6.94%
Occupation	Government Sector	49	12.50%
	Non-government sector	117	30.00%
	Self-employed	224	57.50%
Background of Occupation	Finance related	242	61.94%
	others	148	38.06%

Note: N = 390

4.3 Assessment of Measurement Model

Measurement model is evaluated from reliability and validity perspective. Under the domain of reliability analysis, the first step in evaluating the measurement model is to assess the items' loading. For an item to be considered as reliable, it is desirable that its

loading should be at least 0.70 (Hair et al., 2019). Hence, four items (SA4, OB3, OB4 and ID9) were removed because they carry loading less than 0.70. For sample size of 390 respondents, Table 4 reflected the results of measurement model, and loadings of all the remaining items complying with the minimum threshold. Beside items' loading, another measure of internal consistency reliability is Cronbach's alpha which is also presented in this study. The minimum threshold of alpha is 0.7 (Nunnally, 1978) and Table 4 shows that Cronbach's alpha for all four constructs fall within the acceptable range. Another frequently used measure of internal consistency reliability (Jöreskog, 1971) is Composite Reliability (CR) which in the range of 0.7 to 0.90 is considered satisfactory (Hair et al., 2019). The next step in assessing measurement model is to gauge convergent validity with the help of Average Variance Explained (AVE) which needs to be equal to or greater than 0.50 (Hair et al., 2019). Table 4 depicts the AVE of the underlying constructs of this study and the results validate that convergent validity is established in this model.

Table 4: Item Loading, Cronbach's Alpha, Composite Reliability and Average Variance Explained for Collected Sample (N = 390)

Construct	Items	Loadings	Cronbach's Alpha	Composite Reliability	AVE
Information Acquisition	IA1	0.730	0.865	0.896	0.553
	IA2	0.773			
	IA3	0.744			
	IA4	0.747			
	IA5	0.738			
	IA6	0.732			
	IA7	0.739			
Investor Decisions	ID1	0.730	0.885	0.900	0.521
	ID2	0.778			
	ID3	0.725			
	ID4	0.714			
	ID5	0.714			
	ID6	0.712			
	ID7	0.711			
	ID8	0.706			
	ID10	0.704			
Overconfidence Bias	OB1	0.711	0.847	0.884	0.522
	OB2	0.729			
	OB5	0.715			
	OB6	0.712			
	OB7	0.723			
	OB8	0.733			
	OB9	0.734			
Self-attribution Bias	SA1	0.779	0.857	0.891	0.539
	SA2	0.778			
	SA3	0.711			
	SA5	0.715			
	SA6	0.724			
	SA7	0.720			
	SA8	0.708			

Notes: IA: Information Acquisition, ID: Investor Decisions, OB: Overconfidence Bias, SA: Self-attribution; N = 390

After getting acceptable factor loadings, it is important to assess the discriminant validity of the underlying variables which is essential in confirming that each latent construct is different from other constructs (Hair et al., 2019). Extant literature has suggested Heterotrait-Monotrait (HTMT) Ratio which needs to be less than or equal to 0.850 to ensure the discriminant validity of the constructs (Hair et al., 2016). Table 5 reflects the HTMT ratio of the constructs and confirms the discriminant validity of the construct since all the values are in acceptable range.

Table 5: **Heterotrait-Monotrait (HTMT) Ratio**

	Information Acquisition (IA)	Investor Decision (ID)	Overconfidence Bias (OB)
Investor Decision (ID	0.780		
Overconfidence Bias (OB)	0.804	0.826	
Self-attribution Bias (SA)	0.831	0.848	0.812

Note: $N = 390$

4.4 Assessment of Structural Model

Previous section discussed the reliability and validity of the constructs and results of measurement model confirms that the underlying constructs are valid and reliable. Therefore, these constructs can be used for drawing inference about endogenous variables based on exogenous variables. By using bootstrapping methods, path coefficients along with standard errors, t-statistics and p-values have also been produced in Table 6 and Table 7.

In Table 6, assessment of structural model revealed that overconfidence bias is significantly and negatively associated with investor decision having b =-0.252 with 1% significance level. It indicates that individual investors make irrational decisions because of their overconfidence bias. In the context of demographic profile of investors, 86.94% respondents were male which may contribute towards this finding. Towards interpreting path coefficient, one unit increase in overconfidence bias can reduce investor rationality by 0.252. Since developing countries share numerous institutional, economic and cultural characteristics, therefore, our results are not only consistent with studies specifically conducted in the context of Pakistan (Shah et al., 2018) but also with studies conducted in other developing countries (Pertiwi, Yuniningsih, & Anwar, 2019). Similarly, findings pertaining to self-attribution bias with b = -0.370 is also significantly and negatively associated with investor decisions. This can be inferred that one unit increase in self-attribution bias causes 0.370 units decrease in investor rationality. It is also observed that path coefficient of self-attribution bias is greater than overconfidence bias, which indicates that self-attribution can distort investor rationality more than overconfidence bias. Our results are in line with the findings of Mushinada and Veluri (2019) which is based on the sample from Asian region. Above findings support the hypothesis which expressed that there is relationship of overconfidence bias with investor decisions. Similarly,

hypothesized relationship of self-attribution with investor decisions is also supported with statistical results.

Table 6: **Significance of Path Coefficients**

Hypotheses	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Hypotheses Testing Result
OB -> ID	-0.252	-0.251	0.063	4.009	0.000**	Supported
SA -> ID	-0.370	-0.373	0.052	7.053	0.000**	Supported

Notes: $N = 390$; *Significant at 1% level

4.5 Assessment of Moderation Analysis

Table 7 represents the results of analysis concerning the moderating role of information acquisition on the relationship of overconfidence bias and self-attribution with investors decisions.

Table 7 Significance of Path Coefficients Related to Moderating Variables

Hypotheses	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values	Hypotheses Testing Result
OB*IA -> ID	0.181	0.175	0.072	2.504	0.013*	Supported
SA*IA -> ID	0.055	0.058	0.050	1.105	0.270	Not Supported

Notes: $N = 390$; *Significant at 5% level

In the first row of Table 7, it reflects that interaction effect of information acquisition and overconfidence bias on investor decisions is significant at 5% level with b = 0.181, which indicates that information acquisition moderates the relationship of overconfidence bias with investor decision. Moreover, if path coefficients of overconfidence bias (b = -0.252) in Table 6 and its corresponding moderating variable coefficient (b=0.181) in Table 7 are analyzed, it is interesting to note that the interaction of information acquisition has turned negative impact of overconfidence bias into positive. To put it in simple way, these findings confirm that information acquisition is not only helpful in reducing irrationality caused overconfidence bias, but also it helps investor to make rational decision. Moreover, our results are consistent with the findings of Kong et al. (2020) which argued that the tendency towards information acquisition enables an investors to consider stock related fundamentals and reduced biased behavior. However, the hypothesis which expresses that information acquisition moderates the relationship of self-attribution bias with investor decisions, is not supported due to high p-value (27%) and low beta coefficient (b = 0.055). Since, around one third investors were not much experienced (investment experience up to five years) therefore, this insignificant finding may be associated with insufficient investment experience which may refrain investors from taking advantage of information acquisition in reduce irrational behavior.
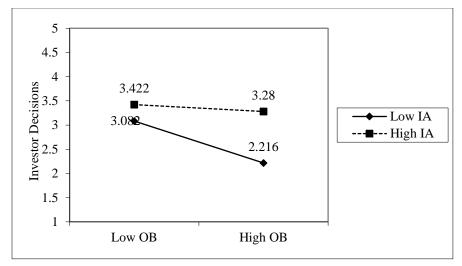
Figure 1: **Moderating Effect of Information Acquisition on Overconfidence**

Figure 2 portrays the moderation effect of information acquisition on the relationship of overconfidence bias and investor decisions. Consider the scenario of "Low IA" (filled line closer to origin), the line is downward sloping and steeper than other line. It indicates that, when information acquisition is low, an increase in overconfidence bias will decrease investor rationality from 3.082 to 2.216. Whereas, in other scenario of "High IA" (consider dotted line), this line is not only above the solid line but also it is less steep than other line. It indicates that the use of more information by the investor, increase his rationality from 3.082 to 3.422 as well as a slight decrease in investor rationality can be resulted with high overconfidence bias (from 3.422 to 3.28). It also suggests that an increase in acquisition of better and relevant information will significantly reduce the loss of rationality caused by overconfidence bias. Thus, the above findings support the hypothesis which postulates that information acquisition moderates the relationship of overconfidence bias with investor decisions.

Figure 3 collectively expresses the path coefficient of structural model including moderation analysis. Values on the line between one rectangle to other show the magnitude and direction of relationship of each independent variable and moderating variable with dependent variable. For example, Figure 3 expresses that overconfidence bias (b =-0.252) and self-attribution bias (b = -0.370) are negatively associated with investor decisions. Same finding are already presented and discussed in details in the context of Table 6 and Table 7.
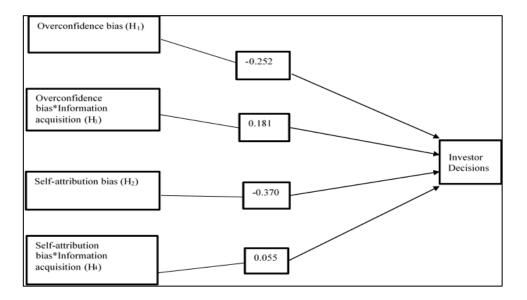
Figure 2: Structural Model Assessment

5. Discussion and Conclusion

The objective of the study was to investigate the effect of overconfidence bias and self-attribution bias on the decision making of individual investors trading in Pakistan Stock Exchange (PSX) along with moderating role of information acquisition on the relationship of above biases with investor decisions. Based on extensive analysis using structural equation model, we confirmed previous findings concerning impairment of individual investors rationality owing to overconfidence bias (Raut et al., 2018; Shah et al., 2018; Jiang & Liu, 2019) and self-attribution bias (Baker et al., 2019; Mushinada & Veluri, 2019). Our study validated that, victims of overconfidence bias and self-attribution bias are likely to make sub-optimal investment decisions. We further confirmed that self-attribution bias is more vulnerable than overconfidence bias in deviating an investor from rationality. Moreover, we added to the existing literature by providing empirical evidence that information acquisition moderates the relationship of overconfidence bias with individual investor's decisions. Simply speaking, improving the sources, quantity and quality of information can help overconfident individual investors in making rational investment decisions. On the other hand, this study does not find any confirming evidence against moderating role of information acquisition on the relationship of self-attribution bias with investor decisions which indicates that irrationality caused by self-attribution bias cannot be overcome by improving the quantity and sources of information.

6. Limitations and Future Directions

There are certain limitations which need to be taken into account while considering implications of this study. Since, findings of this study are based on the sample which

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comprised of more male investors than female. Therefore, it is pertinent to consider the impact of gender on cognitive profile while taking inference from this study. Moreover, the weight of married investors in the sample, is higher than other categories which may impede the generalizability of findings owing to possible divergence in exhibition of biases among categories. Besides, our sample does not allow us to sufficiently examine the behavior of investors having international investment exposure. Therefore, improving sample composition in future, will certainly increase the generalizability of results. Furthermore, psychological state of mind of investor can also be incorporated in behavioral model to better understand the investment decision making of individual investors.

Research Grant

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