

# How financial literacy moderate the association between behaviour biases and investment decision?

Behaviour  
biases and  
investment  
decision

Mohd Adil<sup>ID</sup>, Yogita Singh and Mohd. Shamim Ansari  
*Department of Commerce, Aligarh Muslim University, Aligarh, India*

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## Abstract

**Purpose** – The purpose of the study is to examine the impact of behavioural biases (i.e. overconfidence, risk-aversion, herding and disposition) on investment decisions amongst gender. The authors further examine the moderation effect of financial literacy in the relationship between behaviour biases and investment decisions amongst gender.

**Design/methodology/approach** – The study considered a cross-sectional research design. For this survey, the data have been collected through a structured questionnaire from 253 individual investors of the Delhi-NCR region. To analyse the validity and reliability, the Pearson correlation and Cronbach's alpha test have been taken into account respectively. For testing the hypothesis, hierarchical regression analysis has been used in the study.

**Findings** – The results of the study reveal that amongst male investors, the influence of risk-aversion and herding on investment decision was negative and statistically significant, while the influence of overconfidence on investment decision was positive and significant. However, the influence of disposition was found statistically insignificant. The results stated that amongst female investors the effect of risk-aversion and herding on investment decision was negative and statistically significant. However, the effect of overconfidence and disposition was statistically insignificant influence the investment decision. It has been observed that financial literacy has significantly influenced investment decisions amongst male and female investors. The results of the interaction effect amongst male investors stated that the interaction between overconfidence and investment decision was significantly influenced by financial literacy. However, the interaction of financial literacy with the remaining three biases, i.e. risk-aversion, herding and disposition was found insignificant. The results for the interaction effect of financial literacy with overconfidence, risk-aversion, disposition and herding were found statistically significant amongst female investors.

**Research limitations/implications** – Based on this present research finding, the study is more productive for the portfolio manager and policymakers at the time of making an investment portfolio for the investors based on their behavioural biases. The study recommends that investors need training programmes, workshops and seminars that enhance financial literacy and financial knowledge of investors which helps them to overcome the behavioural biases while making an investment decision.

**Originality/value** – The current study aims to explore whether several behavioural biases can affect investment decisions amongst gender. Moreover, the authors would like to examine whether these associations are moderated by financial literacy. In this sense, financial literacy might also show a substantial part in the prediction of investments. The current study might be of the first study that examines the moderation effect financial literacy amongst male and female investors.

**Keywords** Behaviour finance, Behaviour biases, Overconfidence, Risk-aversion, Herding, Disposition financial literacy, Investment decision

**Paper type** Research paper

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## 1. Introduction

Conventional theories of finance assume individuals as rational investors (Baker and Filbeck, 2013) while taking investment decisions they are evaluating all existing information, several researchers (Barber and Odean, 2008) reveal that investors act irrationally. Researchers like Barber and Odean (2001) emphasize behavioural biases in the financial decisions of investors concentrating on the choice of individual stocks. Several studies reveal that investors are inclined to make deprived investment decisions regarding their investments, resulting in underprivileged investment performance. Behavioural finance proposes that investors show psychological and emotional behaviour which follows to divergence from rational behaviour (Yoong and Ferreira, 2013). Pompian (2012) described that behavioural biases refer to the tendency to make a decision that results in foolish investment decisions because of their mental decline. There are several biases in human psychology (Hoffmann *et al.*, 2010). These biases contain investors' extremely appreciating their predictions (overconfidence), investors more likely to hold losing stock and sell winning stock (disposition), individual investors avoid taking the risk (risk-aversion) and investors follow the crowd (herding). Several research studies also try to enlighten investor behaviour considering several dimensions in addition to investors' biases. For instance, Hoffmann *et al.* (2010) explain that investors using essential analysis are overconfidence, have a trading frequency and more likely to be risk-takers. Lin (2011) recommended that a deficiency of technical ability is the outcome of behavioural biases and an individual can make a well-versed investment decision based on their capability. Nicolosi *et al.* (2009) stated that, in spite of their irrational behaviour, individuals learn from their investment experiences. Research studies majorly conclude that behaviour biases affected the investment decision and education is considered an important tool to overcome biases (Pompian and Wood, 2006) and behavioural biases can handle by using effective ways (Pompian, 2012). Thus, the behavioural biases may work differently according to their education level.

A growing body of literature suggests that financial literacy is now worldwide documented as a significant component of economic and financial stability. Financial avenues such as leasing, mortgages, business loans, credit cards, are now easily accessible to every individual who wanted to capitalize. Financial development needs that funds are utilized rationally consequently extreme value is achieved (Lusardi and Mitchell, 2014). Underprivileged information about finance aspects confuses the process of decision-making and enhanced ambiguity (Cox *et al.*, 2015). Financial literacy helps in managing financial resources effectively. The finding indicates that investors having meagre financial literacy inclined towards irrational or unfavourable investment decisions (Sezer and Demir, 2015; Son and Park, 2019) and more probable to acquire extreme levels of debt (Lusardi *et al.*, 2009). Researchers observed that investors with low financial literacy hold an undiversified portfolio and avoid investment in the stock (Fedorova *et al.*, 2015). The conviction that individuals' having meagre income, as well as financial literacy, are at risk of taking quality investment decisions (Son and Park, 2019) and policymaker consider financial education as a remedy to the poor investment decision but whether it affects the behaviour, it is not yet clear. Behaviour is the aspect of individuals who change according to their acquired information and knowledge and investors invest based on their available information and financial knowledge (Son and Park, 2019). A literate investor can neglect their biases and able to make a sound financial decision (Son and Park, 2019). Several survey studies also attempt to enlighten the importance of financial literacy for rational investment decisions (Lachance and Tang, 2012).

As the existing literature is puzzling, the current study aims to explore whether several behavioural biases can affect investment decisions amongst gender. Moreover, we would like to examine whether these associations are moderated by financial literacy. In this sense, financial literacy might also show a substantial part in the prediction of investment decision. This present study helps to understand the importance of financial literacy amongst gender and how it affects the association between behaviour biases and investment decision. Prior

literature overlooked to consider financial literacy as a moderating variable amongst gender. The present study helps to know how financial literacy affects the behaviour while taking investment decision. The current study might be of critical importance to improve understanding of investment patterns amongst gender in an increasingly worldwide and extremely competitive economy.

Aimed at the aforesaid purpose, the study has been conducted on Delhi (NCR) region's individual investors. The present study offers a corresponding way of proving the theories of behavioural finance and hypothesis and offers powerful reasoning. The paper is bifurcated into six segments. Segment 2 describes a review of the literature. Segment 3 explains the methodology and dataset. Segment 4 discusses the analyses and results. Segment 5 discussion and conclusion, Segment 6 provides implications and finally, Segment 7 provides limitations.

## 2. Literature review and hypotheses

### 2.1 Behaviour biases and investment decision

**2.1.1 Overconfidence.** *Overconfidence* bias mean when investor extremely intensifying their predictions while investing (Budiarto, 2017). Overconfidence of individual investors has significant effect on the investment decisions (Pradikasari and Isbanah, 2018). Bakar and Yi (2016) reveal that overconfidence bias has a significant negative impact on investors' decision-making. Barber and Odean (2001) investigate that overconfidence is less amongst women investors and are also risk-averse compare to men and the trading frequency of the male investors are more compared to female investors and their returns are lower.

*H1a.* Overconfidence bias significantly affects the investment decision of male investors.

*H1b.* Overconfidence bias significantly affects the investment decision of female investors.

**2.1.2 Herding.** (Durand *et al.*, 2013) examine that investors with low confidence, follow the advice of other. (Clarke *et al.*, 2014) investigate herd behaviour amongst institutional. Research studies explore the significant evidence of herd behaviour in Amman Stock Exchange (ASE), Turkish Stock Market and Indian Stock Market by Ramadan (2015), (Cakan and Balagyozyan (2016) and Garg and Gulati (2013), respectively. Malik and Elahi (2014) stated that herding bias significantly affects investors' decisions. Kamil and Abidin (2017) explained the equity investor herd behaviour and their decision-making in the stock market. Hon-Snir *et al.* (2012) explain women are more inclined towards herding bias.

*H2a.* Herding bias significantly affects the investment decision of male investors.

*H2b.* Herding bias significantly affects the investment decision of female investors.

**2.1.3 Disposition effect.** Shefrin and Statman (1985) established a theoretical model regarding disposing of the gaining stock and preference towards counting on the assets which give loss. Investor more likely to hold the loss-making asset whereas tries to sell the gaining stock (Kumar and Goyal, 2015). Bodnaruk and Simonov (2015) studied the existence of disposition effect in the mutual fund managers and no evidence of disposition amongst German institutional investors (Menkhoff *et al.*, 2010). Toma (2015) also found that the investors are inclined to disposition effect while taking investment decision.

*H3a.* Disposition effect bias significantly affects the investment decision of male investors.

*H3b.* Disposition effect bias significantly affects the investment decision of female investors.

*2.1.4 Risk-aversion.* Roth and Voskort (2014) explained that female investors show risk-averse behaviour while male investors are risk bearers. Statman (2010) reveals that professionals' portfolio managers are less prone to take a risk while taking investment decision. Sindhu *et al.* (2014) investigated the cause-and-effect relationship between risk perception and investment decisions. Prior studies prove that women are more risk-averse comparatively to men (Neelakantan, 2010; Barber and Odean, 2001). Moreover, studies reveal that no relationship between the measured risk aversion level and actual behaviour (Pinjisakikool, 2017).

*H4a.* Risk-aversion bias significantly affects the investment decision of male investors.

*H4b.* Risk-aversion bias significantly affects the investment decision of female investors.

### *2.2 Financial literacy and investment decision*

PACFL (2008) describes financial literacy as "the ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial wellbeing". Financial literacy is an important component considered when well-informed investment decision making is considered (Hilgert *et al.*, 2003). Lusardi and Mitchell (2007) revealed the demographic factors influencing financial literacy are: gender, educational qualification, marital status, retirement status, household income, age and several children. Studies reveal that socio-economic factors (i.e. type of employment and status, personal and household income), risk preferences and investment characteristics (i.e. number of investment options, framing of investment options) (Gallery *et al.*, 2011) and males are more financial literate compared to female (Al-Tamimi and Anood Bin Kalli). Chen and Volpe (2002) examined that the financial literacy level amongst the general population of the United States of America (USA), amongst university students (Chen and Volpe, 1998) and the elderly population literacy is low (Lusardi *et al.*, 2014) and low levels of financial literacy affect the investment decision adversely (Al-Tamimi and Anood Bin Kalli) and make irrational investment decision (Bucher-Koenen and Ziegelmeyer, 2011) and investors having a high level of financial literacy make a better investment decision (Hilgert *et al.*, 2003).

*H5a.* Financial literacy significantly affects the investment decision of male investors.

*H5b.* Financial literacy significantly affects the investment decision of female investors.

### *2.3 Behaviour biases, financial literacy and investment decision*

Duong *et al.* (2015) found that investor's knowledge and their decisions about investment and savings can be enhanced at their age of retirement and it seems that demographic factors like gender, age, income are associated with the behaviour of the investor. Ateşa *et al.* (2016) describes a substantial association amongst behavioural biases variables and the level of financial literacy. The finding stated that financial literacy shows a negative effect on framing, overconfidence and loss aversion. Sezer and Demir (2015) conclude that no association exists between investors' behavioural biases and their level of financial literacy. Studies put forward that investors having low cognitive ability along with meagre financial knowledge acquire biases and commit errors in their investment decisions (Bucher-Koenen and Ziegelmeyer, 2011). Sevim *et al.* (2012) examined that a higher level of financial literacy amongst investors encourages them to use their credit cards in an informed manner and not supposed to demonstrate extreme behaviour towards borrowing. Takeda *et al.* (2013) conclude that investors having low-investment literacy are further disposed of with overconfidence while the investors with high-investment literacy are less overconfident.

As mentioned above, it is critical to examine financial literacy and behavioural biases to comprehend the behaviour of investors. There is a rising curiosity amongst behavioural finance researchers in reviewing the effect of financial literacy on individual investors' investing behaviour (Ateşa *et al.*, 2016; Al-Tamimi and Anood Bin Kalli, 2009). Various studies show that

both behavioural biases and financial literacy hold a significant impression on the behaviour of investors. However, the association amongst these two concepts, which has a significant role in investment decisions, has not been investigated in-depth and researches have not observed financial literacy as a moderating variable amongst investor's behaviour biases and investment decisions. A moderator variable is a variable that affects and can modify the strength or form of the association between the dependent variable and its predictor variable. So, grounding on our review of the literature, we recognize that prior research studies ought to overlook the possible significance of moderating variables or are unsuccessful in examining thoroughly. As, research studies have considered financial literacy from the viewpoint of investment performance and decision (Hilgert *et al.*, 2003; Al-Tamimi and Anood Bin Kalli, 2009; Bucher-Koenen and Ziegelmeyer, 2011). In disparity, we inspect this variable as a moderator of the association amongst behaviour biases and investment decisions of individual investors.

The literature on behaviour biases study demonstrates that investors with overconfidence bias overestimate their knowledge (Odean, 1998). Individual who follow the crowd shows herding bias (Clarke *et al.*, 2014). Investors who invest in avenues having high levels of risk to attain maximum returns show their high-risk tolerance behaviour (Hanna and Lindamood, 2004). Investors with disposition effects are more disposed to get rid of gaining stock instead of losing (Shefrin and Statman, 1985). Therefore, we propose that:

- H6a.* Financial literacy moderates the relationship between overconfidence bias and investment decisions amongst male investors.
- H6b.* Financial literacy moderates the relationship between overconfidence bias and investment decisions amongst female investors.
- H7a.* Financial literacy moderates the relationship between herding bias and investment decisions amongst male investors.
- H7b.* Financial literacy moderates the relationship between herding bias and investment decision amongst female investors.
- H8a.* Financial literacy moderates the relationship between risk-aversion bias and investment decisions amongst male investors.
- H8b.* Financial literacy moderates the relationship between risk-aversion bias and investment decisions amongst female investors.
- H9a.* Financial literacy moderates the relationship between disposition effect bias and investment decisions amongst male investors.
- H9b.* Financial literacy moderates the relationship between disposition effect bias and investment decisions amongst female investors.

### 3. Data and methodology

#### 3.1 Research design and survey procedure

A cross-sectional research design has been considered in the study which aims at collective quantifiable exploration in examining the effect of moderation of financial literacy in the association between behavioural biases and investment decision of the investors. The study uses primary data as according to Lin (2011), primary data more exactly imitate the behavioural aspects of investors towards investment decisions compare to secondary data. A survey-based technique has been considered in data collection. According to the objectives of the research, only a particular section of the population is relevant. Hence, data have been collected and considered from "subjectively, but from a relevant segment of the population" (Sahi and Arora, 2012; Davar and Gill, 2007). In the current study, the considered respondents are individuals who invest in several investment avenues (Sahi and Arora, 2012). Moreover,

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individual investors from the Delhi-NCR region are considered as respondents. The reasons for selecting the region are as follows:

- (1) Delhi per capita income is three times the national average income, making it the maximum in the nation.
- (2) Also, it holds trading volume which is more than 60% in the country.
- (3) Regular individuals in this area are financially literate and eligible to invest.

The composition of the sample is decided based on a mixture of a snowball as well as judgement (Sahi and Arora, 2012). The principles for choosing the individual as respondents of the study are mentioned below:

- (1) The individual ought to be an occupant of the Delhi-NCR region.
- (2) The individual obligation to invest in different financial products.

Around 315 individuals were targeted for participating. The survey was managed by sending questionnaires to the individual on a one-to-one basis as well as an online basis. Out of those, 281 responses were received but 28 responses were not properly filled-up. So only 253 responses were taken into consideration.

### *3.2 Respondent profile (refer to Table available in supplementary material to article)*

Based on demographics respondent's profile has been segregated. The significance of variables of demographics like gender, age, investment experience and education in influencing financial literacy and behavioural biases emphasized by several studies (i.e. Barber and Odean, 2001; Hon-Snir *et al.*, 2012). Table available in supplementary material to article represents the summary statistics of respondents.

[Click here](#) to see Table 1: Table available in supplementary material to article.

### *3.3 Survey instrument*

The study is undertaken to inspect whether behaviour biases and financial literacy influences the capability in making investment decisions with the help of a designed questionnaire. The primary segment of the questionnaire comprises four items abetting in giving respondents personal information in addition to details regarding gender, age, education and investment experience. This helps in creating an investor's demographic profile. The remaining question is situation-based which makes the respondents connect to imaginary financial market conditions. The situations are built in a way that their reply imitates their fundamental financial literacy, behavioural biases and investment decision. The situation-based questions are bifurcated into two sections, Section A and Section B. Section A comprises, dichotomous questions related to financial literacy. For Section B, a Likert scale with 5 points is used that ranges from 1 (strongly agree) to 5 (strongly disagree).

### *3.4 Measurements: independent variables, moderator and dependent variable*

This segment represents the dimensions hired in the research (Picón *et al.*, 2014), with a valuation of their measurements and the epistemic association. An epistemic association explains the association between indicators and constructs (Picón *et al.*, 2014). The two kinds of epistemic associations are: A formative measurement model which explains the association between indicators and latent variables and a reflective measurement model which portrays the association between the construct and its indicators (Polites *et al.*, 2012). To incorporate the epistemic association, a designed questionnaire was created and used for the survey. On initial, the questionnaire was distributed to individual investors, for



pre-testing to enhance the presentation of the survey instrument. The questionnaire comprises 24 questions that collect information about financial literacy, behaviour biases (i.e. overconfidence, herding, risk-taking) and their impact on individual investor's investment decisions along with demographic questions. The second segment consists of four questions (dichotomous scale) for examining financial literacy (Lusardi and Mitchell, 2014). The third segment consists of 15 questions (5-point Likert-type scale), for measuring behavioural biases. The scales for the disposition effect, herding behaviour and overconfidence were based on the measurements provided Lin (2011) and risk-aversion is from Weber *et al.* (2002). Furthermore, the fourth segment of the questionnaire consists of five questions (5-point Likert-type scale) related to investment decision which is adopted from Al-Tamimi and Anood Bin Kalli (2009). Table available in supplementary material to article represents the items of questionnaire.

[Click here to see Table 2: Table available in supplementary material to article.](#)

### 3.5 Data analysis

The analysis through moderation scrutinizes association between dependent variable and an independent/predictor, relative of direction as well as size, as a role of a moderation variable (Baron and Kenny, 1986). The moderation test is considered significant in the area of social sciences research (Akhtar *et al.*, 2018) as it explains precisely the type of the causal association between the independent and dependent variables. It can be performed in two ways, i.e. (1) interaction moderation and (2) multi-group moderation. In the first case, the whole data set is used to scrutinize the effect of moderation, while in the latter case, the set of the data is split, which might be a categorical variable (e.g. gender) (Hair *et al.*, 2006). In the current research, in examining planned hypotheses, the statistical techniques used are hierarchical regression analysis. In this, firstly, the behaviour biases measurements were reached into the equation, later predicting investment decision. Secondly, entering financial literacy variables and in the third and last step enter the interaction terms into the equation. Indication for the moderation/interaction effect is noticed if it displays noteworthy increase in the change of dependent variable, i.e. investment decision, which is observable due to introduction of interaction/moderation terms within the equation.

## 4. Results

### 4.1 Hierarchical regression analysis

Descriptive statistics and correlations between the considered variables in the study are depicted in Table available in supplementary material to article.

[Click here to see Table 3: Table available in supplementary material to article.](#)

Reliability analysis is considered to inspect the inner uniformity of the observed factors. Cronbach's alpha test is considered to measure the reliability of the construct. Cronbach's alpha is a reliability test that is used to recognize the association of different items to one another. Research studies reveal that to show consistency, instruments must deliver the reliability coefficient ranging from 0.5 to 0.8 (Pedhazur, 1982). To determine the association amongst all study variables. We conducted the correlation through SPSS and reported results in Table 3. As the correlations absolute values are considerably lower than 0.80, there is no issue of multicollinearity (Hair *et al.*, 2006). hierarchical multiple regression were used to make prediction equation by regulates the sequence of variables entered into the regression equation. Hierarchical regression analysis is used to test the hypothesis of the study (Akhtar *et al.*, 2018; Ahmad, 2020; Aren and Aydemir, 2015).

The results of hierarchical regression analysis are depicted in Table available in supplementary material to article.

Click here to see Table 4: Table available in supplementary material to article.

*4.1.1 Step 1.* In step 1, we introduce the behaviour biases as the main predictors for an investment decision. It was detected that amongst male investors out of the four behaviour biases overconfidence ( $\beta = 0.33, p < 0.05$ ), risk-aversion ( $\beta = -0.56, p < 0.05$ ) and herding ( $\beta = -0.32, p < 0.05$ ) were statistically significant associated to the investment decision. However, the influence of disposition ( $\beta = 0.08, p > 0.05$ ) was found statistically insignificant. The results support the hypotheses (i.e. H1a, H2a and H4a) and not support the hypothesis H3a. The results stated that amongst female investors the effect of risk-aversion ( $\beta = -0.57, p < 0.05$ ) and herding ( $\beta = -0.38, p < 0.05$ ) was significantly associated with the investment decision. However, the influence of overconfidence ( $\beta = 0.05, p > 0.05$ ), and disposition ( $\beta = 0.12, p > 0.05$ ), were insignificantly associated to investment decision. The results support the hypotheses H2b and H4b and not support the hypothesis H1b and H3b.

*4.1.2 Step 2.* In Step 2, we introduce financial literacy, i.e. moderating variable, into the equation; we detected that the financial literacy effect was a statistically significant predictor of investment decision ( $\beta = 1.13, p < 0.05$ ) amongst male investors and ( $\beta = 1.14, p < 0.05$ ) female investors. The result of the regression supports the hypothesis of H5a and H5b.

*4.1.3 Step 3.* In step 3, we examine the moderating role of financial literacy by entering four interaction terms into the equation. Out of the four interaction terms, results stated that the interaction between overconfidence and financial literacy ( $\beta = -0.32, p < 0.05$ ) was significant and the interaction of financial literacy with the remaining three biases, i.e. risk-aversion, herding and disposition were found insignificant amongst male investors. As far as the female investors are a concern, it has been observed that the interaction of financial literacy with overconfidence ( $\beta = 0.59, p < 0.05$ ), risk-aversion ( $\beta = 0.59, p < 0.05$ ), disposition ( $\beta = -0.83, p < 0.05$ ) and herding ( $\beta = 0.55, p < 0.05$ ) were found significant amongst female investors.

Available in supplementary material to article show the graphical representation of interaction between financial literacy and behaviour biases (i.e. overconfidence, herding, risk-averse and disposition) to investment decision amongst female investors and Available in supplementary material to article shows the interaction between financial literacy and behaviour bias (i.e. overconfidence) amongst male investors.

Click here to see Figures 1–5: Available in supplementary material to article.

## 5. Discussion and conclusion

The purpose of the current research is to examine the behavioural factors that influence the investment decision of individual investors amongst gender and to examine the association between behaviour biases (i.e. risk-aversion, overconfidence, herding and disposition) and investment decision when investors choose to invest under the effect of a moderator variable, i.e. financial literacy. We have also anticipated a theoretical background, through the blend of behavioural finance literature. Further, examining that investment decision has an association with behavioural biases of individual investors that influences financial literacy, and concluded about the investors who vary in financial literacy and biases may also vary in their investment proportion and also summarizing that certain behaviour biases such as: risk-aversion, and herding biases negatively and significantly affect the investment decision amongst male investors while overconfidence found positive and significant. However, the disposition effect amongst males was found statistically insignificant. The results also reveal that the effect of risk-aversion and herding was negative and significantly affect the investment decision amongst female investors. However, overconfidence and disposition effects found insignificant while taking an investment decision. Several pieces of



research conclude that these behaviour biases affect the investment decision, i.e. (Hon-Snir *et al.*, 2012; Roth and Voskort, 2014). The result concluded that both male and female respondents tend to follow their peer group and consider the suggestion that given by the peer group, by their friend or broker in deciding to make an investment and having the profit in the future. The results of the regression analysis concluded that male investors are more overconfident while taking investment decisions compare to female investors. And male investor's reaction is too much about the intuition in their self towards the investment they made. The overconfidence of the male investors believes that their knowledge and skills of investment are better than the others. The result is similar to previous findings, i.e. Barber and Odean (2001). The results reveal that financial literacy has a statistically significant and positive influence on investment decisions for both female and male investors. So, according to this, it can be said that it is the most significant factor influencing investment decisions for all the investors at the time of making an investment. The results are similar to the previous findings, i.e. Al-Tamimi and Anood Bin Kalli (2009), Hilgert *et al.* (2003).

The result of regression analysis displays that financial literacy moderates the relationship between overconfidence and investment decision for both female and male investors and reveals that high financially literate males are less prone to overconfidence bias while taking decisions related with investment as financial literacy reduces the positive association between overconfidence and investment decision amongst them. So, financial literacy can be considered as the most significant factor to reduce overconfidence bias. The finding of the study is similar Takeda *et al.* (2013). However highly financially literate female investors tend to be more overconfident and show a positive relationship between overconfidence and investment decision. And hence can be said that financially literate female investors show more overconfidence while taking decision-related with investment. The outcome of the regression analysis explained that financial literacy positively and significantly moderates the relationship between risk-aversion and investment decisions amongst female investors, while the result is statistically insignificant amongst male investors. The result accomplishes that financial literacy reduces the negative connection between risk-aversion and investment decisions amongst female investors. It demonstrates that highly financially literate female investors are more inclined towards risk-aversion. Moreover, it does not moderate the relationship between risk-aversion and investment decisions amongst male investors. The result of hierarchical regression indicated that financial literacy partially moderates the relationship between risk-aversion and investment decision as the financial literacy reduces the positive effect of risk-aversion but the change is not statistically significant and also explained that financial literacy negatively and significantly moderates the relationship between disposition effect and investment decision amongst female investors, while the result is statistically insignificant amongst male investors. So, it can be stated that highly financially literate female investors do not show disposition effect while taking an investment decision. Furthermore, regression test results show that financial literacy statistically significantly moderates the relationship between herding bias and investment decision amongst female investors but insignificant amongst male investors. And results show that highly financial literate female investors consider and make the suggestion from the broker or friend as the final decision for investment and reluctant towards their herding biases.

The results of the regression show that female investors are inclined towards behaviour biases and considered their perception while taking a decision. It shows an increment change in the effect of bias on investment decisions. It has been elucidated by the result that high financial literacy amongst female investors enhanced the effect of biases on investment decisions. Moreover, financial literacy is considered as one of the key aspects that reduce their biases while making a rational investment decision. The regression result concluded that when financial literacy amongst male investors increases, it leads to a decrease in their

behaviour biases. The effect of financial literacy amongst male investors shows a partial moderation effect as financial literacy dampens the positive effect of behaviour biases on investment decisions. Considering the association between investment decisions and the level of financial literacy, it has been detected that highly literate investors consider and practice a variety of techniques while making decisions in comparison with investors with low financial literacy (Khalid *et al.*, 2018). Therefore, it can be concluded that financial literacy can cause substantial disparities between behaviour biases and investment decisions. Outspreading the current literature on behavioural finance considers financial literacy as a predecessor in making an investment decision, and also it is a significant predictor in the association between behaviour biases and investment decisions especially for female investors. Our study is perhaps the only study to anticipate the moderation/interaction effect of financial literacy amongst male and female investors.

## 6. Implications and future scope of the study

Based on the current study findings, several recommendations for managers and individual investors can be made. Furthermore, these findings are more productive for those financial intermediaries and policymakers as it showcases that the rise in the level of financial literacy of people could have a significant effect on their investments. It has been detected that individual investors are prepared to make new investments for better financial returns, but individual investors should be cautious while making an investment. The individual investors pursue the advice or recommendation of agents/brokers and fund managers as they have more experience in this field, and advises them in relation to ensuring various security that the investor wants to invest. The financial advisors should analyse the association between investment risks and investment returns. Moreover, analyse the risk-taking propensity of the investors. An investment plan is not universal, which can satisfy everybody's investment purposes. Therefore, to meet the requirements of individual investors, the portfolio should be made depending upon their gender, age income, education, risk tolerance, etc.

The study also recommends that there can be financial market courses for the investor to help them to do technical analysis of the market before investing. The study recommends that to overcome behavioural biases (overconfidence, risk-aversion, disposition effect, herding bias) and their effect on the investment by conducting training programmes, workshops and seminars that can enhance financial literacy along with financial knowledge of investors and also enhance the capability to comprehend and defend against such biases leading to deprived investment choices and such knowledge should be offered to potential and existing individual investors that can help them to understand how can they avoid such investment decision which may lead to huge financial loss in future.

Like any other research, this also has certain limitations. Firstly, the technique for examining the model assumes that the latent variables possess linear relationships. Secondly, the study was planned through a structured survey questionnaire that was continuously convicted due to general complications. The respondents might feel hesitant in their answers because a structured questionnaire was considered for data collection that may lead to incorrect results. Third, the study has been conducted only on individual investors in one region, i.e. Delhi-NCR. Fourth, the size of the sample, the bigger sample size would empower us to achieve more generalizable outcomes. Lastly, using a mixture of judgemental and snowball sampling techniques, this may have few shortages concerning representability and variability of the population. Therefore, carefulness should be taken when generalizing the results to other regions. We recommend that future research should be done in a different part of the country with different populations, like professional investors, and to determine the extent to which other behavioural biases, like representativeness, anchoring, home bias, etc. and promote the relationship between behavioural biases and investment decision.

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## ORCID iDs

Mohd Adil  <http://orcid.org/0000-0002-8055-2512>

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### Supplementary material

The supplementary material for this article can be found online.

### Corresponding author

Mohd Adil can be contacted at: [Mohammadaadil2050@gmail.com](mailto:Mohammadaadil2050@gmail.com)

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