Prior perceived losses and investment objectives after stock market crisis: a moderated-mediation model of risk tolerance and loss aversion

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Abstract
This study explores whether prior perceived losses affect investment objectives via loss aversion as a mediator and whether the indirect effect is moderated by risk tolerance in a moderated-mediation model. Using retail investors who witnessed a market crash in Bangladesh and experienced losses, the model is tested by employing regression analyses and conditional process. The analyses reveal that prior perceived losses indirectly affect investment objectives (earning a higher expected return and building a financial reserve for future expenses) via mediation of loss aversion. Moderated-mediation model shows that for high-risk-tolerant investors, prior perceived losses indirectly affect investors to invest more for achieving a higher expected return objective and less to achieving building a financial reserve for future expenses, via a low level of loss aversion. These suggest that risk-tolerant investors continue to invest to earn a higher expected return even though they experienced prior losses and are loss-averse.

Keywords Prior perceived losses · Loss aversion · Risk tolerance · Investment objectives · Retail investors · Bangladesh

JEL Classification D14 · D81 · G02 · G11

Introduction
When there is an event of a stock market crash, retail investors are in their majority badly affected and suffer huge losses, resulting in them becoming more sensitive to losses. This is due to the more significant and long-lasting impact of losses than gains. As the losses weigh heavily on investors’ mind, they tend to heed more
on prior losses compared to prior gains. Some of the consequences of prior losses may include but are not limited to revamp investment objectives, restructure investment strategies and portfolio composition, and in worst cases, quit from the market. Among all, setting an investment objective after experiencing losses is most crucial because of its explicit impacts on investment decisions and portfolio performance. For example, speculative objective has an impact on higher aspiration, turnover, higher risk-taking, trading style, and underperformance (Shefrin and Statman 2000; Hoffmann et al. 2010; Cox et al. 2020). On the other hand, saving for retirement objective leads to lower aspiration, less risk-taking, and better diversification (Hoffmann et al. 2010; Khan et al. 2017). However, the role of prior perceived losses in deciding an investment objective is relatively unknown in the literature.

This study, therefore, investigates whether the relationship between prior perceived losses and investment objectives has an indirect effect and whether there is a moderating effect. In this regard, retail investors’ reaction to prior perceived losses is related to both risk-taking and loss aversion, according to two competing theories, i.e., house money effect and prospect theory. Prior studies find that prior losses or gains determine investors’ risk-taking (Thaler and Johnson 1990; Duxbury et al. 2015; Massa and Simonov 2005), whereas prior losses lead to more or less loss-averse (Kahneman and Tversky 1979; Tversky and Kahneman 1991; Merkle 2020). Hence, this study combines four strands of literature (i.e., prior losses, risk-taking, loss aversion, and investment objectives) to identify the underlying mechanism between prior perceived losses and investment objectives. In particular, the study attempts to fill the literature gap by investigating whether the indirect effect of prior perceived losses on investment objectives is moderated by risk tolerance in a moderated-mediation model.

Bangladeshi retail investors provide an ideal ground to test the research gaps, where investors encountered severe stock market crash in 2010–2011. Due to market crash, most of the retail investors lost all their savings and experienced tremendous losses in the market (Ghosh 2010; Chowdhury 2015). During the time of survey, the market was yet to recover and hence investors’ portfolio (Khan 2013; Chowdhury 2015). Therefore, investors’ experience of prior losses in this emerging market is more likely; this is relevant to examine how prior perceived losses affect their decision to set investment objectives and the role of loss aversion and risk tolerance on this relationship, using a first-hand survey data from retail investors experiencing Bangladesh’s market crash.

The study contributes to the literature in the following ways. First of all, this study clarifies the investors’ reaction to prior losses and its impact on loss aversion and subsequent investment objectives. Investors’ perception of prior losses increases their loss aversion, and this, in turn, affects their earning a higher expected return and building a financial reserve for future expenses objectives. The evidence of loss aversion as a mediator combines two strands of literature: one is investors’ reaction to prior losses (Duxbury et al. 2015) and the other is consequences of loss aversion on investment decisions (Merkle 2020; Ang et al. 2005). Second, the study shows that the relation between prior losses and loss aversion depends on one’s level of risk tolerance. The moderating effect of risk tolerance indicates that the impact of prior losses on loss aversion weakens for high-risk-tolerant investors. Apart from
contributing to the literature on risk tolerance (Necker and Ziegelmeyer 2016), this also helps to understand the coskewness puzzle mentioned by Poti and Wang (2010). Third, moderated-mediation effects of risk tolerance and loss aversion in between prior perceived losses and the decision of investment objectives contribute to the literature on behavioral biases and investment objectives. The finding shows that an investor’s decision of investment objective is driven by their experience of prior perceived losses, and this effect differs based on investors’ level of risk tolerance and loss aversion in response to prior perceived losses. Fourth, this study concentrates on retail investors who have experienced stock market crash in an emerging market, while most of the studies cover investors’ behavior in light of crisis in developed markets.

Why Bangladeshi retail investors?

In Bangladesh, most market participants are retail investors—almost 95 percent participation of retail investors and narrow participation of institutional investors (Mahmud 2019a; Speidell 2009). Estimating investors’ behavior in frontier markets is appealing due to the structure of market participants (Speidell 2009). Retail investors in this market witnessed first stock market burst in 1996 and confronted another disaster in 2010–2011. This is the only stock market that encountered two market crashes in South Asian markets (Star Online Report 2019). These stock market crashes incurred tremendous losses that were particularly experienced by retail investors. Hence, they are worried about their investment due to the lack of confidence and prior experience of stock market crashes. Extreme volatility, weak regulations, poor monitoring, and less transparent corporate disclosures were some of the issues, which contributed to prolonged poor performance of the market (Khan 2013). Although there was a new strategic movement when Chinese conglomerates (Shenzhen and Shanghai stock exchanges) acquired 25 percent of stake of Dhaka Stock Exchange (DSE) (Star Business Report 2018), the market was hardly able to regain investors’ positive perception. Retail investors have been suffering losses for the last few years due to the ailing conditions of Bangladesh’s stock market (Mahmud 2019a). Consequently, a considerable number of retail investors pulled out their investment from the market by closing their beneficiary owners’ (BO) accounts. ¹ Beneficiary Owners’ accounts were 3.21 million in December 2010 during the crash, and it has drastically reduced in the subsequent years. Based on the Central Depository Bangladesh Limited’s (CDBL) report, the number of active BO accounts has decreased from 2,766,217 in December 2018 to 2,565,302 in December 2019, possibly due to substantial financial losses, no scope of making a profit, capital erosion, and shortage of confidence (Mahmud 2019b).

¹ To trade in Bangladesh stock market, an investor must open a beneficiary owner (BO) account.
Literature review and theoretical framework

Research on prior perceived losses

There are two competing theories on investors’ reaction to prior losses. Loss aversion theory posits that prior losses increase risk-taking. By contrast, house money effect states that prior losses decrease risk-taking (Thaler and Johnson 1990). The coexistence of both loss aversion and house money effect is shown in China, where individual investors tend to increase risk-taking in response to prior losses and concurrently decrease risk-taking in response to prior losses (Duxbury et al. 2015). When retail investors’ reactions to prior gains and losses are investigated, men are more likely than women to continue investing after incurring losses (Hibbert et al. 2018), whereas prior gains explain investors’ risky asset holdings (Massa and Simonov 2005) and preferences for stocks with higher beta and idiosyncratic risk (Duxbury et al. 2013). Duxbury et al. (2013) further show that prior realized outcomes, be it prior losses or gains, persuade investors to update their beliefs about the distribution of future asset returns and alter their portfolio composition. To somewhat different, self-reported losses during financial crisis show that neither individuals nor parents experience financial losses with the German representative household survey (Bucher-Koenen and Ziegelmeyer 2014).

Research on loss aversion

According to prospect theory, losses loom larger than the equal gains. Investors become more sensitive to losses than gains (i.e., loss aversion) (Kahneman and Tversky 1979; Tversky and Kahneman 1991). Research on loss aversion shows that investors’ reaction to losses differs with the anticipated and experienced returns. Merkle (2020) reports higher loss aversion in response to anticipated returns but lower loss aversion in response to experienced returns. Overestimation or underestimation of loss aversion subsequently influences investment decisions. For instance, a higher level of loss aversion affects less risky portfolio holdings (Merkle 2020) and low stock market participation (Ang et al. 2005). Linking loss aversion with the stock market crashes, Ouzan (2020) developed an equilibrium model conditional on loss-averse traders, information asymmetry, and contagion effect and argued that loss aversion might be a primary reason for market crashes. Besides the cause and effect of loss aversion, Arora and Kumari (2015) documented an indirect effect of loss aversion between demographic factors and risk-taking.
Research on risk tolerance

Risk tolerance is an individual’s like or dislike of risky situations (Pennings and Smidts 2000; Hoffmann et al. 2013). Hoffmann et al. (2015) define risk tolerance as an individual’s general attitude toward financial risk. Hanna and Chen (1998) state that financial risk tolerance is assumed to be inherited from genetic predisposition, and it is a subjective attribute. Financial risk tolerance has been suggested to diminish during a dramatic event such as a crisis, but it is relatively stable over time. For example, the data from Netherlands show that risk tolerance fluctuates during the crisis and it becomes stable over time (Hoffmann et al. 2013); the data from Germany show that those who attributed losses to the crisis reduce their risk tolerance (Necker and Ziegelmeyer 2016); the data from Australia indicate that individual’s financial risk tolerance changes slightly over time (Venter et al. 2012). In investigating the impact of risk tolerance, Hoffmann et al. (2015) report that a higher degree of risk tolerance and upward revisions lead to excessive trading, buy–sell ratios, usage of limit order, and riskier portfolios. The causes of risk tolerance are demonstrated by Fang et al. (2021), where a higher accumulation of wealth and high-income level affect risk tolerance in China. Going one step further, Bapat (2020) found the moderating effect of financial risk tolerance. Financial risk tolerance strengthens the relationship between locus of control and financial management behavior; between financial attitude and financial management behavior; and between financial knowledge and financial attitude.

Research on investment objectives

Prior studies identify different types of investment objectives and their effects on investment decisions. Individual investors state capital growth, hobby, saving for retirement, speculation, and building a financial buffer as their most common and preferred investment objectives (Lewellen et al. 1980; Shefrin and Statman 2000). Such investment objectives have been documented to drive investment decisions varying with the type of investment objective. For instance, speculative objective causes higher aspiration, higher stocks and derivatives turnover, higher risk-taking, judging oneself as more advanced, portfolio concentration, and underperformance (Hoffmann et al. 2010; Hoffmann and Shefrin 2014). On the other hand, those who invest in building a financial buffer or saving for retirement have lower aspirations, take less risk and hold a well-diversified portfolio (Hoffmann et al. 2010; Khan et al. 2017). Further, in an experimental setting, individuals indicate self-expressive goals, which affect their financial performance (Aspara and Hoffmann 2015). However, the sources that lead to setting an investment objective remain unclear.

At this point, investors’ responses to prior losses and their association with loss aversion and risk tolerance and subsequent investment objectives are not
clear in the literature. This is partially due to the scant research on incorporating both loss aversion and risk tolerance in a comprehensive framework, and the different roles played by these two behavior factors when investors decide their investment objectives. Clarifying the indirect role of loss aversion as a mediator and risk tolerance as a moderator on the relationship between prior perceived losses and investment objectives is spotted as a critical research gap.

The present study

Beginning with the indirect impact of prior perceived losses on investment objectives, loss aversion acts as a mediator. Investors who have experienced losses in the past would be more averse to losses due to the larger impact of losses (Tversky and Kahneman 1991). Hibbert et al. (2018) show that prior losses increase negative expectations toward market conditions. Similarly, prior perceived losses may increase investors’ loss aversion. Loss aversion, in turn, has been shown to affect investment decisions, such as portfolio holdings and stock market participation (Merkle 2020; Ang et al. 2005). The subsequent effect of loss aversion may cause investors to follow a conservative or aggressive investment objective before investing in the market. The study formulates the following hypothesis.

**H1** Prior perceived losses lead to increase loss aversion, and loss aversion, in turn, increases the tendency to set different investment objectives, such that prior perceived losses have indirect effects on investment objectives (increase wealth (H1a), earning a higher expected return (H1b), building a financial reserve for future expenses (H1c), preferring fixed income (H1d)), via loss aversion. Loss aversion acts as a mediator.

Investors who experience losses in the past would be more loss-averse than those who experience prior gains. Previous hypotheses established that prior perceived losses increase investors’ loss aversion in testing the indirect effect of prior perceived losses. The link between prior perceived losses and loss aversion may depend on investors’ risk tolerance. This is due to the different reactions to prior losses, such as increasing or decreasing risk-taking tendency (Duxbury et al. 2015). Investors’ prior wealth losses due to crisis decrease risk tolerance and planned risk-taking (Necker and Ziegelmeyer 2016). On the other hand, gains in wealth increase risk tolerance (Fang et al. 2021). Therefore, it can be inferred that prior perceived losses would decrease risk tolerance. The study expects that the coefficient of product between prior perceived losses and risk tolerance affects investors’ level of loss aversion. When prior perceived losses interact with high-risk-tolerant investors, the impact on loss aversion will decrease, i.e., decreased loss aversion. The opposite occurs when prior perceived losses interact with less risk-tolerant investors, i.e., increased loss aversion. The following hypothesis is proposed.
**H2** The positive relationship between prior perceived losses and loss aversion strengthens for low-risk-tolerant investors, whereas this relationship weakens for high-risk-tolerant investors. Risk tolerance acts as a moderator.

Given the proposed indirect effect of prior perceived losses on investment objectives via loss aversion (H1), it is likely to be affected by risk tolerance based on the hypothetical argument of hypothesis (H2) that the interaction between prior perceived losses and risk tolerance affects loss aversion. The indirect effect of prior perceived losses on investment objectives via loss aversion may depend on risk tolerance. This is because the level of risk tolerance may cause one to have different investment objectives. For high-risk-tolerant investors, the indirect effect of prior perceived losses on investment objectives via loss aversion weakens. This means that prior perceived losses are less likely to increase more risk-tolerant investors’ loss aversion, and hence, they have different objectives. On the other hand, for low-risk-tolerant investors, the indirect effect of prior perceived losses is stronger, meaning that prior perceived losses are more likely to increase less risk-tolerant investors’ loss aversion and hence different investment objectives. As there are no prior studies on the above assumption, the study lets the data revealing the role of risk tolerance and loss aversion on the relationship between prior perceived losses and investment objectives.

**H3** The indirect effect of prior perceived losses on investment objectives (increase wealth (H3a), earning a higher expected return (H3b), building a financial reserve for future expenses (H3c), preferring fixed income (H3d)) through loss aversion depends on risk tolerance, such that the indirect effects are weaker (stronger) when risk tolerance is higher (lower).

### Methodology

**Data**

A survey was conducted among small investors in Bangladesh. The sample was drawn from the small investors having a beneficiary owner (BO) account with brokerage houses in the capital city, Dhaka. As the sampling frame was not available, the non-probability convenience sampling was followed. This sampling technique offers some merits as well, e.g., less costly and convenient. In developing the questionnaire, a pre-test with academics (i.e., experts in behavioral finance) and a pilot test with a small scale of retail investors were conducted to get feedback and comments. Before finalizing the questionnaire, a minor amendment was made. The questionnaires were distributed to small investors who visited their own brokerage houses at least once a week. Investors in Bangladesh tend to visit their brokerage houses on weekdays during the operating hours of the Dhaka Stock Exchange (i.e., 10.30 am–2.30 pm). Those who indicated stock
investment as their primary profession tend to visit their brokerage houses regularly. Investors were facilitated with a large projector to monitor the movement of share prices and the market’s overall performance. Most of the day, the brokerage houses were full as the arrangement was made to cater to their clients. With the help of employees dealing with the clients, the questionnaires were distributed to the investors face-to-face. Before approaching investors at the brokerage houses, the potential respondents were filtered out based on the following criteria: minimum qualification of a bachelor degree or diploma, being responsible for own investment decisions, had experienced stock market crash in 2010–2011, and consent to be the part of the survey. The printed questionnaires were in English version for distribution. In case of lack of understanding of English, the respondents approached to the researcher. Then, the English version was directly translated into the mother language and recorded accordingly. The researcher has ensured that the translation had no impact on their true opinion. However, this has occurred only for few cases because all the target respondents were highly educated to understand the level of English language used in the questionnaire. Of the distribution of 450 questionnaires between April 2016 and June 2016, a sample of 223 responses was retained after discarding the incomplete questionnaires. To estimate the sample size adequacy, the study relies on various rules of thumb. Soper’s (2019) sample size calculator for multiple regression analysis was used with the following inputs: anticipated effect size of 0.15, a desired statistical power of 80%, and the probability level of 5% with three predictors. The calculator estimates 76 as the minimum required sample size. Besides, Pallant (2005) suggests 5 times the number of indicators as the required sample size, and based on this study, 70 respondents (5 × 14 indicators) deemed to be sufficient. Moreover, following the rule of thumb by Chin et al. (2003), the required sample size for this study is 80 respondents (8 × 10 constructs), which is according to the number of constructs. As such, the sample size of this study indicates that the collected sample size met the minimum criteria. To address non-response bias (Derby et al. 2011), the early and late responses were computed concerning

**Fig. 1** Conceptual model
demographic variables using $t$ tests, and the outcome showed no significant differences revealing nonexistence of non-response bias.

**(Empirical framework)**

The study investigates whether prior perceived losses indirectly affect investment objectives via loss aversion, and whether the indirect effect is moderated by risk tolerance in a moderated-mediation model. The conceptual framework of the proposed model is drawn in Fig. 1. The model is estimated as follows. First of all, hypothesis H1 (H1a–d), the mediation effect is initially estimated using 3-step procedures of Baron and Kenny (1986), and then, the significance of mediation is tested using a bias-correct bootstrapping step: (step 1) a significant association between prior perceived losses and investment objectives; (step 2) a significant association between prior perceived losses and loss aversion; (step 3) a significant association between loss aversion and investment objectives while controlling for prior perceived losses; (step 4) a significant coefficient for the indirect relationship between prior perceived losses and investment objectives via loss aversion. The first three steps (step 1 to step 3) is estimated using regression analyses (binary logistic and OLS regression). The fourth step (step 4) is conducted by using the bias-corrected bootstrapping analysis (Hayes 2017; Wang et al. 2018).

Second, hypothesis H2 estimates how much the effect of prior perceived losses on loss aversion differs when risk tolerance is high or low. The moderation model is tested by the coefficient of the product of prior perceived losses and risk tolerance. In this linear model, loss aversion (outcome) is estimated as the product of prior perceived losses and risk tolerance (predictors) (Hayes 2017).

Third, hypothesis H3 tests whether the magnitude of mediation effect depends in the value of a moderator. Hypothesis H3a–d states that whether the indirect effect of prior perceived losses on investment objectives via loss aversion is conditional on the value of risk tolerance (Muller et al. 2005). A bootstrap analysis is conducted to examine the conditional indirect effect with the moderation of risk tolerance. A tool, PROCESS macro (Model 7), is introduced to test the moderated-mediation effect (Hayes 2017). The conditional indirect effect of prior perceived losses on investment objectives via loss aversion is estimated as the conditional product of prior perceived losses and risk tolerance. Taking into account the model complexity and statistical power, a sequential model testing strategy is used. Each of the analyses contained a mediator (loss aversion), a moderator (risk tolerance), and an outcome variable (an investment objective). The model has five outcomes (i.e., five different investment objectives), and PROCESS can deal with only one outcome variable at a time. The continuous variables are standardized, and the interaction terms are computed from the standardized scores. The bootstrapping method is applied to obtain robust standard errors for parameter estimation (Hayes 2017). The study has focused on the index of moderated mediation (IMM), which reflects the strength of the indirect effect across the levels of moderator (i.e., the mean, ± 1SD). If 95% bias-corrected confidence intervals (CIs) for the IMM exclude zero with 2000 bootstrapping samples, then the evidence of moderated-mediation is obtained. However, PROCESS
Table 1  Variable description, mean, standard deviation, item loadings, and Cronbach’s alpha

| Variable               | Description                                                                 | Mean | Std. dev | Items loading | Cron. alpha |
|------------------------|-----------------------------------------------------------------------------|------|----------|---------------|-------------|
| Prior perceived losses | The following question is asked (Hibbert et al. 2018)                        | 0.59 | 0.49     | –             | –           |
|                        | My investment performance for the last three months was as follows:          |      |          |               |             |
|                        | On average, I have experienced losses on my investments                      |      |          |               |             |
|                        | On average, my gains are just about as much as my losses                     |      |          |               |             |
|                        | On average, I have experienced gains on my investments                       |      |          |               |             |
|                        | A dummy variable assigns 1 if respondents select ‘On average, I have        |      |          |               |             |
|                        | experienced a loss on my investments’ else 0                                |      |          |               |             |
| Loss aversion          | Modified from Beckmann and Menkhoff (2008)                                  | 3.64 | 0.68     | –             | 0.729       |
|                        | To what extent respondents agree/disagree with the following items:         |      |          |               |             |
|                        | LA1 In case of loss position, I generally wait for a price rebound           | 3.45 | 1.02     | 0.776         |             |
|                        | instead of selling those shares                                             |      |          |               |             |
|                        | LA2 In case of gain position, I generally prefer to sell those shares        | 3.65 | 0.96     | 0.760         |             |
|                        | instead of waiting                                                          |      |          |               |             |
|                        | LA3 I am not willing to sell shares that decreased in value                  | 3.53 | 0.97     | 0.769         |             |
|                        | LA4 I am willing to sell shares that have increased in value                 | 3.93 | 0.70     | 0.658         |             |
| Risk tolerance         | Modified from Hoffmann et al. (2013)                                        | 3.28 | 0.81     | –             | 0.717       |
|                        | To what extent respondents agree/disagree with the following items:         |      |          |               |             |
|                        | RT1 When investing in the market, I prefer uncertainty over certainty        | 2.96 | 1.11     | 0.690         |             |
|                        | RT2 When investing in the market, I do not like to avoid risks               | 3.14 | 1.13     | 0.745         |             |
|                        | RT3 When investing in the market, I like to take financial risks             | 3.36 | 1.08     | 0.750         |             |
|                        | RT4 When investing in the market, I do not like to ‘play it safe’            | 3.66 | 1.09     | 0.757         |             |

Responses are recorded on a scale from 1 (strongly disagree) to 5 (strongly agree).
| Variable           | Description                                                                 | Mean | Std. dev | Cron. alpha |
|--------------------|------------------------------------------------------------------------------|------|----------|-------------|
| Investment objectives | A set of dummy variables. Adapted from Hoffmann and Shefrin (2014). Investors are asked to select only one investment objective | –    | –        | –           |
|                    | Assign 1 if respondent states ‘saving for retirement’ as investment goal, else 0 (reference category and thus did not include in the analyses) | 0.04 | 0.20     |             |
|                    | Assign 1 if respondent states ‘increase wealth’ as investment goal, else 0     | 0.28 | 0.44     |             |
|                    | Assign 1 if respondent states ‘earning a higher expected return’ as investment goal, else 0 | 0.25 | 0.43     |             |
|                    | Assign 1 if respondent states ‘building a financial reserve for future expenses (e.g., children’s education, marriage)’ as investment goal, else 0 | 0.17 | 0.37     |             |
|                    | Assign 1 if respondent states ‘preferring fixed income’ as investment goal, else 0 | 0.27 | 0.44     |             |
has some limitations; for example, this method is confined to the continuous or binary dependent variables; it is unable to combine serial multiple mediation with moderation; the variables used in PROCESS are measured as observed variables, which might have an issue of measurement error (Hayes 2012).

**Measurement of variables**

The definition of variables with references, mean, standard deviation, item loadings, and Cronbach’s alpha is reported in Table 1. Prior perceived losses, loss aversion, risk tolerance, and investment objectives are adapted from existing studies (Hibbert et al. 2018; Beckmann and Menkhoff 2008; Hoffmann et al. 2013; Hoffmann and Shefrin 2014). The sample of the survey questionnaire is reported in appendix. Prior perceived losses are coded as a binary variable with a mean value of 0.59 and a standard deviation of 0.49. As loss aversion and risk tolerance have multiple items, the reliability of these variables is confirmed by Cronbach’s alpha. Loss aversion and risk tolerance have values of 0.729 and 0.717, respectively. The single factor solution assures the validity of both variables (Hoffmann et al. 2013). The dependent variables, investment objectives, are recorded as dummy variables. The mean values of five investment objectives, coded as binary variables, are shown in the table, where the saving for retirement objective is used as a reference category.

**Results**

**Demographic profile of investors**

Table 2 shows the demographic characteristics of survey participants. From this table, the majority of respondents are male, comprising 87%. Majority of investors’ age falls between 25 and 35 years old (37.2%), following the age category between 35.1 and 45 years old (32.3%). Only a few investors are above 55 years old (12.1%). Most of the investors are married, comprising 83%, whereas 17% of investors are single. About 98.2% of investors have completed their university degrees. More than a quarter of investors involve in business occupation (29.1%), while only 1.3% of investors are unemployed/housewives. When it is about the annual income of investors, a majority of investors fall in the income category of 1,00,000TK-5,00,000TK (1,219USD-6,097USD) (1 US Dollar = 82BD TK in 2016) per annum (43%). Only 2.2% of investors have an annual income over 15,00,000TK (17,550USD) yearly. Investors are mostly from a family consisting 6–8 family members, following 3–5 members in the family. Respondents are asked about the size of their stock investment in terms of the investment amount. A large portion of investors (47.5%) hold a stock portfolio worth more than 1,00,000TK (more than 1,170US$). The lowest amount of stock portfolio (1–25,000TK) is held by only 1.3% of investors. This indicates that respondents who participated in the survey have invested a certain amount in the stock market. The majority of investors have 7–10 years of investment experience (60.5%) at the time of the survey. About 31.8% of investors have more than
Table 2 Demographic characteristics of participants

| Item                        | Classification          | Frequency | Percent (%) |
|-----------------------------|-------------------------|-----------|-------------|
| Gender                      | Male                    | 194       | 87.0        |
|                             | Female                  | 29        | 13.0        |
| Age                         | Below 25 years old      | 8         | 3.6         |
|                             | 25–35 years old         | 83        | 37.2        |
|                             | 35.1–45 years old       | 72        | 32.3        |
|                             | 45.1–55 years old       | 33        | 14.8        |
|                             | Above 55 years old      | 27        | 12.1        |
| Marital status              | Single                  | 38        | 17.0        |
|                             | Married                 | 185       | 83.0        |
| Education                   | University degree       | 219       | 98.2        |
|                             | Non-university degree   | 4         | 1.8         |
| Occupation                  | Self-employment         | 39        | 17.5        |
|                             | Business                | 65        | 29.1        |
|                             | Finance related sector  | 45        | 20.2        |
|                             | Entrepreneur/private sector | 48     | 21.5        |
|                             | Retired                 | 23        | 10.3        |
|                             | Unemployment/housewives  | 3         | 1.3         |
| Annual income\(^a\)         | Less than 1,00,000TK    | 33        | 14.8        |
|                             | 1,00,000–5,00,000TK     | 96        | 43.0        |
|                             | 5,00,001–10,00,000TK    | 73        | 32.7        |
|                             | 10,00,001–15,00,000TK   | 16        | 7.2         |
|                             | More than 15,00,000TK   | 5         | 2.2         |
| Household size              | 1–2                     | 9         | 4.0         |
|                             | 3–5                     | 91        | 40.8        |
|                             | 6–8                     | 97        | 43.5        |
|                             | More than 8             | 26        | 11.7        |
| Stock investment            | I don’t own any stock   | -         | -           |
|                             | 1–25,000TK              | 3         | 1.3         |
|                             | 25,001–50,000TK         | 28        | 12.6        |
|                             | 50,001–75,000TK         | 33        | 14.8        |
|                             | 75,001–1,00,000TK       | 53        | 23.8        |
|                             | More than 1,00,000TK    | 106       | 47.5        |
| Investment experience       | < 7 years               | 17        | 7.6         |
|                             | 7–10 years              | 135       | 60.5        |
|                             | > 10 years              | 71        | 31.8        |
| Experienced stock market    | Yes                     | 223       | 100         |
| crash 2010–2011             | No                      | 0         | 0           |

\(^a\)1TK = 0.0121USD, the exchange rate is subject to change

n = 223
Table 3  The mediation effect between prior perceived loss and investment objectives

| Predictors                        | Model 1a                  | Model 1b                  | Model 1c                  | Model 1d                  | Model 2                  | Model 3a                 | Model 3b                  | Model 3c                  | Model 3d                  |
|-----------------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
|                                   | Increase wealth (Inv. Obj.) | Earning a higher expected return (Inv. Obj.) | Building a financial reserve for future expenses (Inv. Obj.) | Preferring fixed income (Inv. Obj.) | Loss aversion | Increase wealth (Inv. Obj.) | Earning a higher expected return (Inv. Obj.) | Building a financial reserve for future expenses (Inv. Obj.) | Preferring fixed income (Inv. Obj.) |
| Prior perceived losses            | -0.668** (0.324)          | -0.293 (0.295)            | 1.360*** (0.473)          | 0.057 (0.297)             | 0.178* (0.092)           | -0.621 (0.327)           | -0.397 (0.302)           | 1.539*** (0.486)          | 0.002 (0.301)             |
| Loss aversion                     |                           |                           |                           |                           |                           |                           |                           |                           |                           |
| Constant                          | -0.879*** (0.229)         | -0.677*** (0.221)         | -2.663*** (0.422)         | -0.879*** (0.229)         | 3.535*** (0.071)         | 0.165 (0.843)            | -2.553*** (0.882)        | -0.022 (0.962)            | -1.943** (0.836)          |
| Nagelkerke R-square               | 0.029                     | 0.006                     | 0.077                     | 0.000                     | 0.016                     | 0.039                    | 0.039                    | 0.140                     | 0.111                    |
| Hosmer–Lemeshow (Chi-square)      | 0.000                     | 0.000                     | 0.000                     | 0.000                     | 0.000                     | 9.190                    | 19.443**                 | 15.069**                 | 22.389***                |

Panel B: Bootstrapping indirect effects of prior perceived losses on investment objectives via loss aversion using PROCESS (step 4)

| Indirect effect (SE)              | -0.053 (0.052)            | 0.093 (0.079)             | -0.139 (0.086)            | 0.053 (0.044)             |
| [LLCI, ULCI]                      | [-0.195, 0.010]            | [0.000, 0.323]            | [-0.365, -0.005]          | [-0.011, 0.177]           |

Each column is a regression model that predicts the criterion at the top of the column. Standard error is reported in parenthesis.

SE standard error, LLCI lower limit confidence interval at 95%, ULCI upper limit confidence interval at 95%. 2000 bootstrapping resamples are generated. *p < 0.1, **p < 0.05, ***p < 0.01
ten years of experience, whereas only 7.6% have less than seven years of investment experience. Investment experience of respondents indicates that investors are likely to have basic knowledge about stock investment. All the investors in the sample had gone through the stock market crash in 2010–2011.

**Moderated-mediation analysis**

**Mediation analysis**

The first hypothesis states the indirect effects of prior perceived losses on investment objectives (increase wealth (H1a), earning a higher expected return (H1b), building a financial reserve for future expenses (H1c), and preferring fixed income (H1d)) through loss aversion.

Panel A of Table 3 reports the results of regression analysis (binary logistic regression and OLS). The results show that prior perceived losses have significantly direct effects on the likelihood of increasing wealth objective (beta = −0.668, p < 0.05) (Model 1a) and building a financial reserve for future expenses (beta = 1.360, p < 0.01) (Model 1c). Prior perceived losses have insignificant effects on earning a higher expected return (beta = −0.293, p > 0.10) (Model 1b) and preferring fixed income (beta = 0.057, p > 0.10) (Model 1d).

The result for the direct effect in step 2 shows that prior perceived losses have a significant and positive impact on loss aversion (beta = 0.178, p < 0.10) (Model 2).

In step 3, loss aversion has a significant positive impact on the likelihood of earning a higher expected return (beta = 0.525, p < 0.05) (Model 3b) and a significant negative impact on the likelihood of building a financial reserve for future expenses (beta = −0.780, p < 0.01) (Model 3c), after controlling for prior perceived losses. Loss aversion turns insignificant for the investment objectives of increase wealth and preferring fixed income. The coefficient of loss aversion is insignificant and likely to affect increase wealth objective (beta = −0.297, p > 0.10) (Model 3a). Similarly, loss aversion is insignificant and likely to affect preferring fixed income objective (beta = 0.298, p > 0.10) (Model 3d) with the presence of prior perceived losses. The results indicate that prior perceived losses affect loss aversion; loss aversion in turns affects the probability of earning a higher expected return and building a financial reserve for future expenses objectives.

The significance of the indirect effect is tested by the bootstrapping method of bias-corrected confidence intervals using SPSS PROCESS macro. The results as shown in Panel B of Table 3 indicate that loss aversion has no significant indirect effect between prior perceived losses and investment objective of increase wealth as the value 0 does contain within the lower and upper intervals. H1a is thus not supported. For earning a higher expected return objective, the bootstrapping results show that loss aversion has a significant indirect effect between prior perceived losses and earning a higher expected return at 95% confidence interval, where the value 0 does not contain between the intervals. This shows support for H1b. Prior perceived losses also have a significant indirect effect on building a financial reserve for future expenses via loss aversion at 95% confidence interval, where the value 0
does not fall within the intervals. Thus, H1c is supported. In the case of preferring fixed income objective, prior perceived losses have no significant indirect effect via loss aversion at 95% confidence interval as the value 0 does contain between the intervals. Therefore, H1d is not supported.

**Moderation analysis**

The second hypothesis states that the relationship between prior perceived losses and loss aversion strengthens for low-risk-tolerant investors, and this relationship weakens for high-risk-tolerant investors. It estimates how much the impact of prior perceived losses on loss aversion varies with risk tolerance. This hypothesis is assessed by OLS regression. As reported in Table 4, it is observed that the coefficient of the product of prior perceived losses and risk tolerance is significant and positive (beta = 0.272, \( p < 0.05 \)) (Model 5). The direct effect of prior perceived losses on loss aversion (beta = 0.135, \( p < 0.05 \)) (Model 4) becomes weaker in Model 5 (beta = −0.700, \( p > 0.10 \)) when prior perceived losses interact with risk tolerance. The interaction effect indicates that the relationship becomes weaker for high-risk-tolerant investors. For high-risk-tolerant investors, prior perceived losses have less effect on loss aversion. Prior perceived losses cause investors to be less loss-averse, given that they are more risk-tolerant. Thus, risk tolerance acts as a moderator, and hypothesis H2 is supported.

**Moderated-mediation analysis**

Hypothesis H3 assumes that risk tolerance would moderate the indirect relationship between prior perceived losses and investment objectives through loss aversion. A bootstrap analysis is conducted to examine the indirect effect of prior perceived losses on investment objectives with the moderation of risk tolerance. Model 7 in PROCESS macro is introduced to test the moderated-mediation effect (Hayes 2017; Preacher et al. 2007). As shown in Table 5, prior perceived losses have no indirect effect on increase wealth for low level of risk tolerance (beta = 0.008, SE = 0.056, 95% CI [−0.097, 0.133]) and high level of risk tolerance (beta = −0.123, SE = 0.094, 95% CI [−0.280, 0.007]). For individuals with a low level of risk tolerance, prior perceived losses also have no indirect effect, via loss aversion, on earning a higher expected return (beta = −0.014, SE = 0.091, 95% CI [−0.228, 0.159]). For
Table 5  Moderated-mediation analyses: risk tolerance and loss aversion in between prior perceived loss and investment objectives

| Conditional indirect effects of | Increase wealth | Earning a higher expected return | Building a financial reserve for future expenses | Preferring fixed income |
|--------------------------------|-----------------|---------------------------------|-----------------------------------------------|-----------------------|
| Risk tolerance                 |                 |                                 |                                               |                       |
| − 1SD                          | 0.008           | 0.056                           | −0.014                                        | 0.021                 |
| Mean                           | −0.057          | 0.055                           | −0.010                                        | 0.101                 |
| + 1SD                          | −0.123          | 0.094                           | −0.349                                        | −0.151                |
| IMM                            | −0.081          | 0.067                           | 0.280                                         | −0.324                |

|                     | Effect | SE    | LLCI | ULCI | Effect | SE    | LLCI | ULCI | Effect | SE    | LLCI | ULCI | Effect | SE    | LLCI | ULCI |
|---------------------|--------|-------|------|------|--------|-------|------|------|--------|-------|------|------|--------|-------|------|------|
| Increase wealth     | 0.133  | 0.056 | −0.133| 0.091| −0.228 | 0.159 | 0.021| 0.129| −0.199 | 0.330 | −0.008| 0.058| −0.181 | 0.077 |      |      |
| Earning a higher expected return | 0.101  | 0.079 | 0.000 | 0.326 | −0.151 | 0.087 | −0.385| −0.025| 0.057  | 0.047 | −0.004| 0.195 |        |      |      |
| Building a financial reserve for future expenses | 0.218  | 0.135 | 0.028 | 0.584 | −0.324 | 0.159 | −0.716| −0.074| 0.124  | 0.091 | −0.019| 0.359 |        |      |      |
| Preferring fixed income | 0.007  | 0.143 | 0.011 | 0.439 | −0.212 | 0.142 | −0.582| −0.015| 0.081  | 0.074 | −0.011| 0.310 |        |      |      |

Bold text indicates the significance of moderated-mediation index

*SE* standard error, *LLCI* lower limit confidence interval at 95%, *ULCI* upper limit confidence interval at 95%, IMM index of moderated mediation. 2,000 bootstrapping resamples are generated. Values in bold support the hypothesized moderated mediation. Savings for retirement objective are used as reference category.
individuals with high level of risk tolerance, prior perceived losses have a positive indirect impact on earning a higher expected return (beta = 0.218, SE = 0.135, 95% CI = [0.028, 0.584]). For the investment objective of building a financial reserve for future expenses, there is no indirect effect for low-risk tolerance (beta = 0.021, SE = 0.129, 95% CI = [−0.199, 0.330]). For high-risk tolerance, prior perceived losses negatively impact building a financial reserve for future expenses via loss aversion (beta = −0.324, SE = 0.159, 95% CI = [−0.716, −0.074]). For the investment objective of preferring fixed income, prior perceived losses have no indirect effect for low-risk tolerance (beta = −0.008, SE = 0.058, 95% CI = [−0.181, 0.077]) and high level of risk tolerance (beta = 0.124, SE = 0.091, 95% CI = [−0.019, 0.359]). The results suggest that a high level of risk tolerance is associated with the prior perceived losses and loss aversion in deciding one’s investment goal (i.e., earning a higher expected return and building a financial reserve for future expenses).

The index of moderated mediation is significant for earning a higher expected return (95% CI = [0.011, 0.439]). As the level of risk tolerance increases, the indirect effect of prior perceived losses on earning a higher expected return objective via loss aversion increases to a significant level (risk tolerance of +1 SD at the high level, consisting of no 0). The index of moderated mediation is significant for building a financial reserve for future expenses (95% CI = [−0.582, −0.015]). As the level of risk tolerance increases, the indirect effect of prior perceived losses on building a financial reserve for future expenses, through loss aversion, decreased to a significant level (risk tolerance of +1 SD at the high level, having no 0). Therefore, hypotheses H3b and H3C are partially supported.

Discussion

The findings show the evidence of a moderated-mediation effect of risk tolerance and loss aversion on the relationship between prior perceived losses and investment objectives. The evidence was specifically demonstrated for investment objectives of earning a higher expected return and building a financial reserve for future expenses. Before establishing the moderated-mediation effect, the findings indicate loss aversion as a mediator between prior perceived losses and investment objectives (earning a higher expected return and building a financial reserve for future expenses) and risk tolerance as a moderator between prior perceived losses and loss aversion.

Concerning the investment objective of earning a higher expected return, the indirect effect of prior perceived losses via loss aversion can be interpreted as those who experienced losses in the past tend to be more loss-averse because individuals react more to losses than gains. As the losses have a larger impact (Tversky and Kahneman 1991), investors become more loss-averse and reluctant to realize any losses further. Therefore, loss-averse investors are more likely to invest in order to earn a higher expected return and set this goal as their investment objective. Loss-averse investors may tend to recover their losses as early as possible by aiming to earn higher returns. Loss aversion also acts as a mediator between prior perceived losses and the objective of building a financial reserve for future expenses, but prior perceived losses negatively impact building a financial reserve.
for future expenses. Investors become more sensitive to the realization of losses and hence become loss-averse. It is observed that loss-averse investors are less likely to set their goal in building a financial reserve for future expenses. Building a financial reserve involves pursuing a long-term strategy, and accomplishing this goal may take longer to recover their losses. These findings are consistent with Merkle’s (2020) and Arora and Kumari’s (2015) studies, but differ regarding the indirect effect of prior perceived losses in deciding investment objectives via loss aversion.

The evidence shows that the relationship between prior perceived losses and loss aversion is the product of risk tolerance and prior perceived losses. For high-risk-tolerant investors, prior perceived losses have less influence on loss aversion. This means that when high-risk-tolerant investors realize losses, they tend to seek higher risk, which is consistent with prospect theory (Kahneman and Tversky 1979; Tversky and Kahneman 1991). Prior perceived losses reduce loss aversion propensity for high-risk-tolerant investors. The moderating effect of risk tolerance is relevant with prior studies (Casidy and Wymer 2016; Bapat 2020) and adds to the literature in relation to prior perceived losses and loss aversion.

Moving forward, the findings confirmed the moderated-mediation effect between prior perceived losses and investment objectives (earning a higher expected return and building a financial reserve for future expenses). Prior perceived losses cause investors’ likelihood of investing with the aim to earn a higher expected return. This process is moderated-mediated by risk tolerance and loss aversion. For high-risk-tolerant investors, perception of prior losses on loss aversion weakens and makes investors less loss-averse. Less loss-averse investors, in turn, intend to invest to earn a higher expected return. Such investors (i.e., high-risk tolerance and low loss aversion) are less likely to invest to build a financial reserve for future expenses. It is plausible that high-risk-tolerant investors are not interested to build a financial reserve for future expenses because they are unlikely to follow less risky passive investment goals.

The finding that more risk-tolerant investors seek higher returns after prior losses contribute to the asset pricing literature in explaining the coskewness puzzle. After the losses, the market is priced at the margin by more risk-tolerant investors on the upside. Due to the fact that market returns exhibit mean-reverting behavior, there is a possibility of gains following losses. This finding may help understanding the coskewness puzzle stated by Poti and Wang (2010). According to the puzzle, the estimated shape of the representative investors’ utility function resembles an ‘inverse S’ function, i.e., risk-loving over gains.

The results obtained on the moderated-mediated channel between prior perceived losses and investment objectives are new in the literature, specifically, in emerging markets. The findings can serve as a suitable representative of an emerging market considering the typical characteristics of emerging markets such as more retail participation, lack of disclosure, and regulatory system. Also, the results might be relevant to larger capital markets with regard to investors’ typical response to prior perceived losses, the moderated-mediation process of risk tolerance and loss aversion, subsequent investment objectives, irrespective of stock market crises.
Conclusion, implication, and future research

While existing studies examined the impact of investment objectives on a broad range of portfolio decisions, lack is known about the causes of investment objectives. This study tests how prior perceived losses influence investment objectives via loss aversion as a mediator and whether this mediating effect is moderated by risk tolerance in a moderated-mediation model. Retail investors who experienced losses due to a catastrophic stock market crash in 2010–2011 in Bangladesh were selected as the targeted sample. The study demonstrates that risk tolerance moderates the indirect effect of prior perceived losses on earning a higher expected return and building a financial reserve for future expenses via loss aversion, where prior perceived losses cause high-risk-tolerant investors to be less loss-averse and more likely to invest for earning a higher expected return and less likely to invest for achieving to build a financial reserve for future expenses.

The findings imply that retail investors who realized losses in the past may consider investing for earning a higher expected return and are unlikely to consider building a financial reserve for future expenses. This might be due to the mean-reverting behavior of stock market. As there is a mechanism of loss aversion and interaction of risk tolerance, the causes of investment objectives are moderated-mediated by behavioral biases. Therefore, it is also suggested not to be vulnerable to any behavioral biases such as risk tolerance and loss aversion when deciding investment objectives before making investment decisions. Investors should be careful about their response to prior perceived losses and how it affects their investment goal. Generally, investors react to prior perceived losses and accordingly set their investment objectives. Risk tolerance as a moderator and loss aversion as a mediator suggests retail investors should be able to find ways to de-bias in setting their investment objectives. They should concentrate less on investment losses in the past as it may raise potential behavioral biases.

Future research may be conducted with retail investors in other emerging markets, which encountered stock market crash and investors experienced losses, to establish the generalizability of the findings given the same framework. This is to ensure whether the findings are a general phenomenon or specific characteristics of Bangladeshi retail investors. Taking into account the context of the market crisis produced during the COVID-19 pandemic may be another avenue for future research considering the variables studied in this research in the context of a market crash.

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Declarations

Conflict of interest  There are no competing interests.

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