

*Do you follow your head or your heart?
The simultaneous impact of framing
effects and incidental emotions on
investment decisions*

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Do you follow your head or your heart? The simultaneous impact of framing effects and incidental emotions on investment decisions

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ABSTRACT

This study is situated in an investment context and explores how the effect of framing (gain versus loss framing) changes the impact of incidental emotions (fear and excitement) on behavioral and physiological outcome measures. While existing literature has found that the effects of framing and incidental emotions both impact decision-making independently, the present study extends this literature to test the simultaneous influence of both gain and loss framing, which has been previously neglected. Sixty participants were randomly divided into groups induced with different incidental emotions (fear/excitement/control). They were asked to make investment choices on thirty investment scenarios by choosing between a safe and a risky investment option presented towards either possible gains or losses associated with financial investments.

Our findings suggest that the interplay of framing and incidental emotions does indeed produce novel effects beyond those described in the current literature. For example, participants in the “fear group” prefer more risky investment options in the gain scenarios than participants in the “excitement group”. Most importantly, the interaction between the effects of framing and excitement makes participants myopic about the advantages of risky investment options, whereas the same interaction shows a reverse effect in participants experiencing fear.

1. Introduction

Retail investors (RIs, i.e., individuals who purchase a financial product for their own personal account, see Investinganswers.com, 2020), typically have to choose between financial products that seem reasonably safe – such as saving products that earn a low rate of return – and products that may be riskier – such as shares that can earn a higher. This choice can be troublesome and confusing, particularly within a turbulent financial market such as that created by the unsettling environment of a global pandemic, set against a backdrop of ever changing product offerings by financial institutions (Al-Thaqeb et al., 2020; Locke et al., 2015). It has been suggested that a media-created hype fueling strong emotions further increased market volatility when COVID-19 hit the hardest (Haroon & Rizvi, 2020). Recent findings show that households who were directly affected by COVID-19 lost some confidence in the economy, and were more likely to engage in risk-averse behavior by changing their investment portfolios (Yue et al., 2020). An emotionally charged investment environment brings to the forefront the need to understand the interaction of different variables that can impact RI

decision-making.

The way financial product information is framed (i.e., whether the possibility for gain or the danger of loss is highlighted) may impact the outcome of the decision, particularly if RIs are not knowledgeable or confident in their abilities to understand financial terminology and information. Indeed, regulatory bodies such as the Financial Conduct Authority (FCA, 2017) suggest that the impact of information framing is not well understood in practice and call for related research. At the same time, the FCA has highlighted the need to understand how the emotional state of individuals may also play in the decision-making process. Of particular novel interest is whether individuals who experience emotions at the time of their decision-making, even if unrelated to the actual decision (i.e., incidental emotions, carried over from another situation), may be impacted in their choice towards a safe or risky outcome without realizing it (Lerner & Keltner, 2000). This study aims to shed light on how the effect of framing can change the investment risk propensity of individuals who simultaneously experience incidental emotions such as fear and excitement. From an applied perspective, this study aims to produce insights that can be used to inform regulatory bodies and

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financial institutions about the role and interplay of framing of the context and incidental emotions when setting the scene for retail investors to make appropriate choices. The well documented impact of framing effects in economic decision-making led financial institutions to focus more on the way information is presented and neglect the additional impact of feelings which might change the direction of the framing effect as our findings show.

To the best of our knowledge, there is only limited empirical evidence on how incidental emotions and the framing of choice presentation interact to elicit risk seeking or risk averse behavior. Casotti et al. (2012) showed that a positive emotional context did not encourage risk seeking behavior, but on the contrary, discouraged risk propensity in the loss frame condition. Except for this valuable academic contribution, previous studies - on the whole - have investigated the effects of framing and incidental emotions on human decision-making separately. The otherwise impressive body of knowledge in these areas currently lacks a conceptual and empirical investigation of the interaction effects. This is troublesome, as human beings are complex individuals who experience thoughts and feelings simultaneously, somehow resolving potential tensions internally to derive at an observable outcome behavior (Juliussen et al., 2005). The conclusions derived from previous work are therefore limited and it remains unclear how the impact of framing effects and incidental emotions may diminish or increase risk seeking or risk adverse behavior when experienced simultaneously. The current study contributes to the literature by conceptualizing the impacts of framing effects and incidental emotions simultaneously and offers new empirical findings to add to the current debate. Importantly, the current work is set in the context of investment-related decisions, an area that has received increasing attention in literature and offers an important real-world context to a novel academic inquiry (Hillenbrand et al., 2019). This is in contrast to most of the existing body of knowledge based on willingness to pay for a lottery ticket, and which is not empirically relevant in the investment setting where the expected pay-offs are based on a distribution of returns rather than a pure win or lose.

It is well known that investors, both lay and experts, can deviate from optimal choices as a number of factors play an important role in the decision-making process (Moore et al., 1999). It is also established that “stable factors” such as gender, income, and age impact retail investors (RIs) (Diouf et al., 2016; Gilad & Kliger, 2008). Notably, “transient factors”, which include emotions and cognitive biases, also have substantial impacts on RIs. RIs rely on a lay perception of the risk associated with investments and hence their perception can be more guided by transient situational factors, including feelings and cognitive biases (Cornil et al., 2019). Finally, it is important to note that, in this context, the relatively small sample size can potentially limit the generalizability of the results.

2. Literature review

2.1. The impact of integral and incidental emotions on decision making

Emotions can significantly impact the decision-making process by changing an individual's propensity to be more (or less) risk adverse and therefore less (or more) risk tolerant (Loewenstein et al., 2001). In this context, it is important to distinguish two types of affective influences: expected and immediate influences. *Expected influence* refers to the emotions experienced when individuals make predictions about the possible consequences of an action (e.g., a good or bad investment decision), while *immediate influence* includes all the emotions experienced at the moment of the choice (e.g., anxiety, fear or excitement) (Loewenstein et al., 2001). Furthermore, immediate influences can be divided into what are by definition called “integral emotions” and “incidental emotions” (Loewenstein & Lerner, 2003). Incidental emotions are defined as those experienced at the moment of the choice, but they arise from sources that are not related to the decision itself (Scott & Loewenstein, 2008). Differently, the concept of integral emotions is used

to define a set of emotions experienced in the immediate situation in which a person is making a choice (Loewenstein & Lerner, 2003).

Two decades of research have documented the tendency of incidental emotions to affect judgments and decisions, which is the focus of this study (Lerner et al., 2004). The two emotions fear, and excitement have been singled out in previous research as particularly relevant to the context of financial decisions when experienced “incidentally” (Lee & Andrade, 2011).

For instance, fear is an emotion that encourages pessimistic judgments and previous research has found that it triggers risk-averse choices (Lerner & Keltner, 2001) as well as more exploration of pay-offs (Frey et al., 2014). On the contrary, excitement is an emotion that encourages optimistic judgments and has been suggested to trigger risk-seeking behavior (Kuhnen & Knutson, 2011). Specifically, the literature suggests that when individuals experience fear before taking an unrelated risky decision (an incidental experience) their propensity towards risk significantly decreases (Lerner & Keltner, 2001). Moreover, incidental happiness seems to influence decision weights by triggering an observable increase in risk taking in lottery choices (Schulreich et al., 2014). A similar result has been found for excitement that seems to enhance individuals' risk propensities in financial decision-making (Kuhnen & Knutson, 2011). Based on the existing literature, we hypothesize that:

H1: Individuals induced with fear and excitement select significantly different proportions of risky investments.

Hence, we expect a main effect of the emotion induction in which participants assigned to the fear group choose significantly fewer risky investment choices than individuals induced with excitement.

Differently, integral emotions have been studied as anticipatory unconscious emotions that guide decision making under risk (Damasio, 1996). The intensity of integral emotions can be measured via different physiological indices, among which the most important are Skin Conductance Response (SCR) and Heart Rate (HR). Previous studies show a strict link between the emotional response in terms of body changes and risk propensity (Lo & Repin, 2002). It has been found, for example, that inducing stress triggers a different SCR in individuals if they perform under negatively or positively framed scenarios. Under negative frames, participants show significantly higher SCR under stress than under positive frames (Ring, 2015). The hypotheses tested in this study are in line with the Somatic Marker Hypothesis in which the physiological aspects of integral emotions play a leading role in guiding risk preferences (Bechara & Damasio, 2005). In particular, we hypothesize that:

H2: The average of SCR and HR (preceding each choice) is higher in the loss frame than in the gain and control frames, independently from the groups (fear, excitement, and control).

2.2. Framing effect and priming effect

Studies in psychology and economics look at the framing effect to describe the phenomenon that a person's perception of information and subsequent decision-making can be altered depending on how information is portrayed (Kahneman & Tversky, 1979). Tversky and Kahneman (1979), in their seminal work, pioneer the exploration of how human beings make decisions in terms of risk tolerant or risk averse behavior when the frame of the problem is manipulated by the experimenter. They, and subsequent authors (Armstrong, 1988; Cheng & Chiou, 2008; De Martino et al., 2006), conclude that when people face problems described in terms of losses, they often prefer a risky choice, while a problem described in terms of gains seem to encourage choices perceived as safe. The traditional definition of the term “framing effect” refers to the description of probabilistic options (e.g., monetary) in terms of lose or gains (Tversky & Kahneman, 1981). An important

distinction in terms of the definition of the framing effect, and consequently in terms of the methodology, seems to be the one that considers how a specific element or attribute within a text is framed. In particular, Levin et al. (1998) distinguish between *attribute framing*, when the frame is changed in an attribute of the decision option (e.g., “if we say that a gamble is successful with 70 % of probability, we are implicitly saying that there is 30 % chance of not being successful”), and *goal framing*. The latter refers to changes in the frame of the relationship between behaviors and goals (e.g., “if you get vaccinated, you take advantage of protection against COVID-19”, or “if you do not get vaccinated, you do not take advantage of protection against COVID-19”). In the present study, we adopt the term “framing” to define the methodology used to manipulate the “loss” and “gain” conditions by changing the *attribute framing* of the decision option. Furthermore, the characteristic of the *attribute* was emphasized by including other presentation methods that help to put a certain frame or perception around a manipulation variable (such as the use of color to present information). The technique adopted for the present study is a combination of attribute framing (gain versus loss), color (red versus green), and news (positive versus negative). Using a mixed methodology by including frames and priming is not new – for instance, a study conducted by Chien (2011) found that combining framing effect techniques (gain versus loss frame) and priming techniques (different colors) has an impact on individuals’ willingness to get vaccinated. In the present study, a similar methodology is adopted to consider the most common variables that can impact real investment decisions (i.e., the frame of the investment, color of the brochure, real investment news).

The decision-making process is known to be affected by numerous variables that take place subconsciously. Investors are simultaneously exposed to different external factors that, without awareness, might change their risk propensity.

Priming is a technique that unconsciously activates the cognitive availability of certain memories or information, leading human decisions in different directions. Furthermore, the priming effect is focused on the consequence of exposure to any kind of material that may subconsciously affect it. When accessible schemas are activated in memory, they influence the way people process information (Gilad & Kliger, 2008) – for example, priming manipulation may affect word recognition or even memory (Tulving & Schacter, 1990). Previous studies have also highlighted the impact of negative news on investment decisions that might dramatically change the way RIs weigh losses and gains (Barberis & Thaler, 2002). For example, previous studies have shown that increasing the mental salience of positive (or negative) experiences by *priming techniques* increases (or decreases) subsequent risk taking behavior (Alempaki et al., 2019). Such studies place a responsibility on financial advisors to ensure that their clients possess sufficient knowledge to make appropriate decisions and put misleading news into context.

Priming techniques can be used to simulate how various stimuli presented in the environment around us may, unconsciously, affect our decisions.

In the field of financial decision making, previous literature has highlighted the importance of understanding the impact of informative channels (e.g., TV, newspapers) on individuals’ risk attitudes (Huberman & Regev, 2001; Klibanoff et al., 1998). For instance, manipulating the colors used to represent a stock price has been found to have an impact on investors’ decisions. It seems that individuals exposed to the color red assign higher probability of losses when evaluating securities compared to subjects exposed to the color green (Kliger & Gilad, 2012).

Previous research has studied the effects of priming on decision making with the purpose of understanding the impact of environmental stimuli at a subconscious level. Similarly, financial decisions are not exempt from external influences that might change individuals’ risk propensities. Existing studies showed that risk predilections are affected by situational factors such as whether the words employed have positive or negative connotations for risk (Gilad & Kliger, 2008). It has also been

demonstrated that the way the media uses information and colors in advertisements and news changes people’s risk preferences (Kliger & Gilad, 2012). Moreover, real life investment evidence gathered on professional investors supports the hypothesis that fear elicited by priming investors with negative investment scenarios triggers risk adverse behavior. In the light of these findings, three blocks (neutral, gain frame, and loss frame) were created with the aim of predisposing participants towards the disadvantages or advantages of investing in risky assets. We hypothesize that:

H3: The Gain frame encourages a higher number of risky investment options, whereas the Loss frame encourages a higher number of safe investment options.

2.3. The interaction between incidental emotions and framing effects

The hypotheses formulated above build upon the impact of emotions and framing effects separately. However, the interaction between the impact of emotions and the framing effect is an important aspect because the emotional component may change the propensity of individuals to be more risk seeking in the loss frame (Cheung & Mikels, 2011a).

Cheung and Mikels (2011) conducted a study to show the relationship between the role of affect and risk propensity, finding that participants were more likely to engage in risk seeking behavior when they are instructed to take the decision based on their emotions. In addition, the results suggested (Cheung & Mikels, 2011b; Zhao, 2006) that positive emotions experienced at the moment of the choice lead to a greater probability to choose a gamble option. These results support the hypothesis of an interaction between emotions and the frame of the sentence, although, the procedure used by Cheung et al. (2011) does not include any emotional induction, only a self-reported measure of the participants’ affect state. The authors interpreted their findings in accordance with the biosocial-affect model (Romer & Hennessy, 2007), which proposes that positive feelings increase the likelihood of adopting risky behavior. More studies found that affects not only have a direct influence on interpretation of a decision’s outcome, but also moderates the effect of framing (Mittal & Ross, 1998). Specifically, it seems that individuals induced with a negative mood are more likely to be influenced by the framing of the sentence in their interpretation, and their risk propensity increases when the frame of the sentence represents a “threat” rather than an “opportunity” (Mittal & Ross, 1998). Specifically, the authors found that a negative emotional state increases the individuals’ chances of being more affected by the framing of the sentence. In accordance with the mood-repair hypothesis (Leith & Baumeister, 1996), the authors concluded that individuals in a negative emotional state try to move towards a positive emotional state by engaging in risky choices. Although, the results of all these studies take us towards a greater understanding of the relationship between emotions and framing, the question remains as to what happens when specific incidental emotions (such as fear and excitement, which are particularly important in economic decisions) are experienced while investment information is presented in terms of losses or gains.

The conclusions derived from previous work are therefore limited and it remains unclear how they might simultaneously impact investment choices. The current study contributes to the literature by conceptualizing the simultaneous impact of framing effects and incidental emotions (fear and excitement) and offers new empirical findings to add to the current debate. The hypotheses of the present study have been built on the evidence presented above, in particular, as far as transferable:

H4a: Individuals assigned to the excitement group choose a significantly higher number of risky investments compared to the fear (and control) group. This behavior is intensified when individuals make choices in gain frame scenarios.

H4b: Individuals assigned to the fear group select a significantly lower proportion of risky investments compared to the excitement (and control) group. This behavior is intensified when individuals make choices in the lose frame scenarios.

3. Materials and methods

3.1. Participants

As the context for this study is investment decisions, the population to be sampled from is set as working adults with sufficient disposable income to be likely to consider personal investment decisions. Professionals working at the University where the study was conducted (the name of the department will later be disclosed) in a variety of different roles and functions, both including academics and administrators (no students were allowed to take part) were recruited through flyers, emails, and social media to take part in the study. They were invited to an individual session in a lab at the University where the research was conducted.

A total of 60 participants (20 per group) comprising 42 females and 18 males (Age range: 41.67 % was between 25 and 34 years old, 20 % was between 35 and 44 years old, 23.33 % was between 45 and 54 years old, 15 % was between 55 and 64 years old) took part in the study in exchange for £25 in Amazon vouchers for a one-hour individual session. An inclusion criterion to select the sample was adopted, specifically that participants must have been 25 years of age or over to ensure a response sample as close as possible to the composition of those making investment decisions since it is unlikely in reality that people below this age would have a permanent job and be thinking about investing life savings. In addition, individuals with diagnosed color-blindness were excluded from taking part in the study since the color of the words was manipulated across the blocks. Twenty participants were assigned to the Fear group (15 females and 5 males), and twenty were assigned to the Excitement group (13 females and 7 males). Twenty participants were assigned to the Control group (14 females and 6 males). In addition, individuals with diagnosed color-blindness were excluded from taking part in the study since the color of the words was manipulated across the blocks. Although efforts were made to ensure data accuracy and reliability, the study's conclusions may be limited by the small sample size, potentially affecting the robustness of the statistical analyses conducted. The study was approved by the University Ethics Committee.

3.2. Material and apparatus

HR and SCR were simultaneously recorded using Power Lab 26T (ADInstruments) and the software program LabChart 8.0 (ADInstruments). SCR was recorded using two 15 × 20 mm contact area finger electrodes attached to the distal phalanges of the index and middle fingers on the non-dominant hand. HR was recorded using three MLA1010B ECG Electrodes, attached to the area below the collar bone (positive and negative poles), and in the ankle bone of the left leg (ground pole).

SCR and HR were recorded at the beginning of the session when participants rested for few minutes (baseline recorded for five minutes) and then for the duration of the task. The analysis was performed on the signal four seconds (s) at the onset of the scenario and before the participant's choice.

3.2.1. Task

At the beginning of the task, participants provided some demographic information such as gender, age, annual income, propensity to invest in stocks, and propensity to invest in bonds. Without time restriction, participants could start the task when ready and perform 30 hypothetical investment scenarios divided into three blocks. Participants were asked to choose as they would in real life. However, no real money was invested and no outcome/feedback on the choice was given.

It would not have been appropriate to reward particular behaviors more than others since in our setup there was no 'right answer'; rather, we wanted each respondent to freely express their risk preferences. Each block consisted of a combination of 10 scenarios with different temporal returns (short, medium, long), but almost equal annualized returns. Specifically, the annualized return on each trial was calculated for short temporal horizons (from 1 to 3 years), medium temporal horizons (from 5 to 7 years), and long temporal horizons (from 10 to 12 years). The three blocks were created to bias participants towards the negative effects of investing ("Lose" block), the positive effects of investing ("Gain" block), and no bias ("Control" block) (Fig. 1). The three blocks (Control, Gain, and Lose) were presented in a random order.

In the Gain and Lose blocks, participants were biased towards the likelihood of losing or gaining money with different priming techniques. The techniques used can be summarized as follows:

1. Manipulation of the word color: with this technique, falls were emphasized with the red color in the Lose block only, whereas the color green was used in the Gain block to highlight the possible returns (see Fig. 1).
2. Increasing awareness of the act of investing: at the beginning of each block, a piece of descriptive text appeared to explain the concept of "market fluctuations". In particular, the descriptive text in the Gain/Lose blocks explained the advantages/disadvantages, in terms of monetary returns, of investing.
3. Increasing financial knowledge through real news: randomly, some negative/positive news was presented about the shares of the biggest companies in the market taken from the Financial Times or BBC websites.
4. Mental representation of possible future consequences: participants were asked to choose between a list of options what were their "financial worries/ dreams" (Lose/Gain block) if they lose/gain money in a bad/good investment.

In a temporal order, participants were asked to read a brief piece of descriptive text on "market fluctuations" before starting each block. The descriptive text at the beginning of the Lose block highlighted the dangers and disadvantages of investing in risky assets, whereas the descriptive text at the beginning of the Gain block highlighted the benefits of investing in risky assets.

Blocks were randomized and counterbalanced across participants. However, to ensure that the participants would be primed towards gains or losses in each block, trials were presented in a sequential order so that they read the news always before making a choice. Hence, participants were exposed to real selected negative/positive news about investing while performing the task. New sets of questions were also created in which participants were actively invited to think about the possibility of losing or earning money and the possible future consequences.

3.3. Procedure

At the beginning of each session, participants were informed that their participation was completely voluntary, and that they could withdraw from the session at any time without giving any explanation. They were also told that all the data collected was anonymous. Each participant read the information sheet and signed the consent form. Participants were assigned randomly to one of the groups (Control, Fear, or Excitement). The randomization of the groups was done *a priori*.

After signing the consent form, participants were invited to complete the self-reported scale of negative and positive affect, PANAS-X (20 items – see (Watson & Clark, 1994)). The PANAS-X was used to measure what emotions participants were experiencing in that specific moment rather than measuring a more permanent state such as mood (Heller et al., 2009; Morris et al., 2016). Subsequently, the physiological equipment was placed and tested until the signals for both HR and SCR were neat and clear. Participants were invited to take a few minutes of

Example of a scenario in the “Gain” Block

Imagine that you are investing for a 1- year period. You will receive the payment at the end of the year. Choose one of the two options that sounds more appealing to you:

OPTION 1: A savings account where the value of your investment will definitely increase by 1% in total.

OPTION 2: A financial product where the value of your investment has an equal chance of either **INCREASING** in value by 25% (or falling by 10%).

Example of a scenario in the “Lose” Block

Imagine that you are investing for a 1- year period. You will receive the payment at the end of the year. Choose one of the two options that sounds more appealing to you:

OPTION 1: A savings account where the value of your investment will definitely increase by 1% in total.

OPTION 2: A financial product where the value of your investment has an equal chance of either **FALLING** in value by 8% (or increasing by 20%).

Example of a scenario in the “Control” Block

Imagine that you are investing for a 1- year period. You will receive the payment at the end of the year. Choose one of the two options that sounds more appealing to you:

OPTION 1: A savings account where the value of your investment will definitely increase by 1% in total.

OPTION 2: A financial product where the value of your investment has an equal chance of either increasing in value by 27% or falling by 11%.

Fig. 1. Three examples of short- term scenarios across the blocks (Gain, Lose, and Control) are shown in Fig. 1. Option 2 varies in each block, whereas Option 1 is always presented with an unbiased style.

rest and then participants assigned to the Fear and Excitement groups were asked to answer two questions (see details below) whereas those assigned to the control group were asked to rest for longer.

Hence, the three blocks can be better depicted as follows: a “Lose block”, in which participants were exposed to negative attribute framing, negative news related to investments, and the color red as warning; a “Gain block”, in which participants were exposed to positive attribute framing, positive news related to investments, and the color green as reassurance; a “Control block”, in which participants were exposed only to neutral news (no attribute framing was modified and no colors used).

Before starting the financial investment task, participants assigned to either the fear or excitement condition, were asked to answer two questions in order to induce either fear or excitement. The first question asked them to list three to five events in their lives in which they felt fearful/excited depending on the group they were assigned to. In the second question, they picked the most fearful/exciting event and described it in detail. After that, they were asked to complete the PANAS-X again.

4. Results

4.1. Investment preferences

To test the first two hypotheses and to investigate any interactions between cognitive biases and emotional induction (H1 and H2), a 3 (groups = Neutral, Fear, and Excitement) X 3 (blocks = Control, Lose, and Gain) mixed repeated measure ANOVA was performed. The results showed a main effect of the priming manipulation, which suggested that regardless of the emotion induction, people differ in the proportions of risky choices across the three blocks $F(2, 114) = 7.964, p = .001$. Specifically, post-hoc paired-sample t -tests indicated that all participants made a higher number of risky choices in the Gain block compared to the Lose block $t(59) = 3.675, p = .001$ (Cohen's $d = 0.474$), 95 % CI [.05, .16], and a higher number of risky choices in the Control block compared to the Lose block $t(59) = 3.019, p = .004$ (Cohen's $d = 0.390$), 95 % CI [.03, .14] (Fig. 2).

In addition, no significant differences were found between the Gain and Control blocks.

Moreover, paired sample t -tests to detect differences between blocks within each group separately show that:

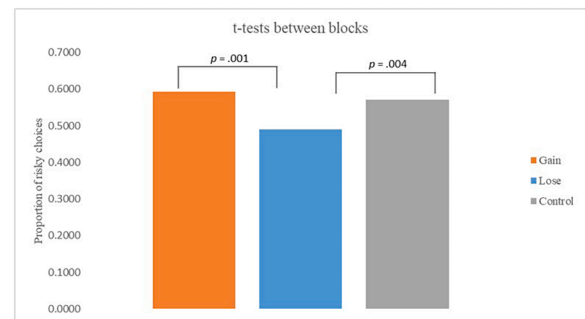


Fig. 2. Post-hoc paired sample t -test on the proportion of risky choices to compare performance within blocks.

- 1) in the Neutral group, there were significant differences between Gain and Lose $t(19) = 2.091, p = .05$ (Cohen's $d = 0.467$), 95 % CI [.24, 0.0001] and between Lose and Control $t(19) = 3.746, p = .001$ (Cohen's $d = 0.838$), 95 % CI [.09, 0.30].
- 2) In the Fear group, there were significant differences between Gain and Lose $t(19) = 3.77, p = .001$ (Cohen's $d = 0.845$), 95 % CI [.06, 0.21] and between Gain and Control $t(19) = 3.286, p = .004$ (Cohen's $d = 0.735$), 95 % CI [.04, 0.19]; but no significant differences were found in the excitement group on the proportion of risky choices between blocks.

A significant interaction between groups and blocks was also observed $F(2, 114) = 3.05, p = .02$. In particular, post hoc independent t -tests indicate that there were significant differences between the Neutral and Excitement groups in the Gain block $t(38) = 2.34, p = .025$ (Cohen's $d = 0.740$), 95 % CI [.28, 0.39] and the Control block $t(38) = 3.61, p = .001$ (Cohen's $d = 1.142$), 95 % CI [.14, 0.86,]. In addition, there were significant differences between the Fear and Excitement groups in the following blocks: a) Gain block $t(38) = 3.3, p = 0.002$ (Cohen's $d = 1.045$), 95 % CI [.15, 0.48]; b) Lose block $t(38) = 2.06, p = .046$ (Cohen's $d = 0.652$), 95 % CI [.004, 0.43]; c) Control block $t(38) = 2.09, p = .044$ (Cohen's $d = 0.660$), 95 % CI [.006, 0.40] (Fig. 4).

4.2. SCR and HR during decisions

The main purpose of the physiological analysis was to investigate variations in SCR and HR during decisions within the three blocks

(Control, Lose, and Gain) to test the third hypothesis (H3). SCR and HR were recorded with the purpose of measuring the intensity of integral emotions and the role that they have in guiding decision making when participants were biased with different priming techniques.

SCR raw signal was amplified and digitized through a 16-bit A/D converter at 1 kHz. The signal was converted from volts to micro-Siemens using AD instrument software (AD Instrument Ltd, Chalgrove, Oxfordshire). The magnitude of each response was calculated as the difference between the onset and the maximum deflection in the four second window before a choice was made. SCR magnitudes for each participant were calculated by averaging SCR values for each trial.

SCR and HR measured at the baseline after the emotional induction (2 min' rest) showed no significant differences between the Fear and Excitement groups.

On the contrary, a 3 (groups) X 3 (SCR in the three blocks) mixed repeated ANOVA, where the dependent variable was the average SCR four seconds before the choice on each scenario, showed that, independently from the groups, there was a main effect of the blocks in the SCR $F(2, 118) = 3.772, p = .025$. Post hoc paired sample t -tests showed that participants in the Lose block had a significantly higher SCR than in the Control block $t(59) = 2.239, p = .029$ (Cohen's $d = 0.289$), 95 % CI [.0007, 0.012], and they had a higher SCR in the Gain block than in the Control block $t(59) = 2.027, p = .047$ (Cohen's $d = 0.262$), 95 % CI [.00004, 0.007] (Fig. 5).

Regarding HR, a 3 (groups) X 3 (HR in the three blocks) mixed repeated measure ANOVA, where the dependent variable was the average of HR four seconds before the choice on each scenario, showed a trend of significance for the main effect of the blocks $F(2, 114) = 2.55, p = .08$. However, since "tests of within-subject contrasts" revealed a significant difference between the two blocks, a post hoc paired sample t -test was run and showed that participants in the Lose block had a significantly higher HR than in the Gain block $t(59) = 2.08, p = .042$ (Cohen's $d = 0.268$), 95 % CI [.03, 1.4] (Fig. 6).

4.3. Response time (RT)

Conducting an analysis of RTs allows us to investigate the relationship between cognitive effort and the type of response (risky versus safe) in the three blocks. Mixed repeated measure ANOVA showed a main effect of the blocks $F(2, 114) = 10.37, p = .000$. Post hoc paired sample t -tests showed that: participants' RTs were faster in the Control block compared to the Gain block $t(59) = 3.06, p = .003$ (Cohen's $d = 0.396$), 95 % CI [.6, 2.84,]; and the Lose block $t(59) = 4.8, p = .000$ (Cohen's $d = 0.620$), 95 % CI [1.58, 3.8]. There were no significant differences in RTs between Gain and Lose (Fig. 7).

4.4. The effect of covariates on risk behavior (gender, income, propensity to take risk)

Demographic information such as gender, income and risk propensity were separately entered as covariates in the mixed repeated ANOVA, but none of them had a significant impact on the proportion of risky choices.

5. Discussion

The present study was designed to inform academics and practitioners on how the interaction between incidental emotions (i.e., fear and excitement) and cognitive biases may affect investment preferences among RIs. Although stable factors such as gender and income have been widely demonstrated to have an impact on investment preferences, research on transient factors has mostly considered the impact of emotions (e.g., incidental emotions such as fear and excitement) and cognitive biases (elicited by the framing of the sentence) separately.

The findings of this study are in line with the previous literature regarding the strong impact of transient factors such as attribute

framing, news, text color of financial facts concerning investment choices (Chien, 2011; Tulving & Schacter, 1990). The study's conclusions should be interpreted carefully due to the limited generalizability resulting from the small sample size. Our first hypothesis H1 is supported, and in fact it seems that these factors strongly change the propensity of RIs who prefer investing in risky assets when exposed to the gain frame context (which includes positive attribute framing, positive news and green color) independently from their gender or income.

Interestingly, although H2 regarding any differences between the Fear and Excitement groups was confirmed, the results show that H4b was not confirmed as individuals assigned to the Fear group prefer to invest their savings in risky assets more than individuals assigned to the Excitement or Neutral group, and in addition, it seems that this risky behavior is exacerbated in the Gain block. Although these results are not in line with our hypothesis in which we expected that excitement would have caused an increase and fear a decrease in the number of risky investments, they add important novel findings around the impact of incidental emotions on investment choices and they can be explained by adopting the *mood-maintenance hypothesis*. In fact, while the previous literature that investigated the sole impact of fear on economic decisions speculated that fear enhances risk adverse behavior (Lerner & Keltner, 2001) and excitement enhances risk seeking behavior (Kuhnen & Knutson, 2011), the present findings elucidate how the risk tendency of RIs changes when other variables such as attribute framing, positive/-negative external news and color interact with the impact of incidental fear and excitement. It seems that participants assigned to the Fear group experienced a significantly higher level of stress (or perhaps a higher arousal as an incentive to change their negative mood) when performing in the Lose block. To understand this data, we need to look at the SCR and HR activity. As stated by the SMH, and in line with our expectation (H2), before taking a decision that involves a high level of risk, individuals show an increase in the SCR. Hence, in line with the SMH, the findings of the present study highlight the importance of somatic markers preceding the choices. In fact, participants developed an increase of the SCR in the Lose block meaning that their somatic response correctly "warned" them of the possible risk of investing in the Lose block compared to the Control and Gain blocks. The present results suggest that the variability in the SCR is associated to the stimuli, and this supports the idea that SCR activity reflects the effect of *emotions-as-input* rather than SCR activity reflecting the effect of *emotions-as-outcome* (Davis et al., 2009).

The interesting and novel result here is that the interaction between cognitive biases elicited by the attribute framing and priming techniques (color of the text and news) and incidental emotions (H3) leads RIs to be more risk tolerant when they experienced fear and when they were simultaneously exposed to the negative effects of investing compared to the control and excitement groups. There are different interpretations regarding this result. It might be that when individuals experience fear, they are more susceptible to stress, which enhances somatic markers and consequently increases individuals' propensity towards risk (Porcelli & Delgado, 2009).

Previous studies showed that a high level of stress increases risk behavior in the loss domain Porcelli and Delgado (2009) and tolerance of uncertainty (Byrne et al., 2020), which is consistent with the dual-process approaches as people rely more on automatized risk biases (Evans, 2003). Other studies also confirmed that individuals become more risk taking in economic decisions when they experience high levels of chronic stress (Ceccato et al., 2016). Interestingly, the exacerbation of risk taking behavior found in our research (Gain block) has also been found in a previous study and explained as a "conversion" of fear into excitement when contextual clues suggest positive outcomes and do not reinforce fear (Lee & Andrade, 2015). Another explanation can be found in the *mood-incongruent effect* that is observable when a negative incidental emotion influences the judgement of a target as more positive (Västfjäll et al., 2016).

At the same time, participants assigned to the Neutral group made a

significantly higher proportion of risky choices in the Control block, so it seems that when RIs approach investment choices without the effect of incidental fear or excitement they tend to prefer risky assets if external information is not presented in terms of gains or losses.

Furthermore, H4a was not confirmed as results show that individuals assigned to the Excitement group showed a significantly lower proportion of risky choices across the three blocks without any significant differences. It seems that in this group, participants tried to move towards a more conservative and safer behavior to maintain their positive mood, in accordance with the mood maintenance hypothesis (Isen, 1984), which states that individuals in a positive mind-set tend to engage in risk adverse behavior to maintain a positive feeling and avoid a negative one. It seems that individuals who experience a “positive feeling” suffer less from cognitive biases elicited by attribute framing, external news or information about investing. Additionally, as our brain engages in self-preservation behavior, it is also possible that beliefs are formed in order to activate actions to maintain a positive emotional state and avoid a negative one (Kuhnen & Knutson, 2011).

The findings of the present study add important academic and practical knowledge regarding the behavior of RIs in the most common investment question they ask themselves: “Shall I invest my lifesavings in a risk-free account or in shares?” If an RI had to answer this question from a “rational” perspective, he/she would want to invest the money that he/she is willing to lose and hence in many cases should prefer a riskier option over a safe one motivated by the desire to improve his/her economic status. However, the majority of RIs look for an alternative to invest and secure their money, and hence they ask for professional advice. Commonly, financial advisors rely on easy and fast sets of questions to identify the risk preferences of their clients, but this practice ignores the strong impact of transient factors on the final decision.

5.1. Implications for research and practice

To conclude, the current findings have implications for informing research and practice in the context of investment preferences. The study confirms the importance of incidental emotions in guiding decisions and, most importantly, their “ability” to moderate the effect of framing (and priming). Fear, for example, can be exacerbated by external sources (e.g., news) and turned easily into stress which enhances a physiological response that increases the probability of risky behavior. On the other hand, a positive feeling (e.g., excitement) might completely neutralize the effect of additional external information and make the investor myopic about the advantages of a slightly risky decision. The interaction between the Neutral group and Fear also group adds interesting, novel results. Fig. 3 shows that in the Neutral group there are no differences between the Control and Gain blocks in the proportion of risky choices, whereas the direction moves in the opposite way in the Fear group, where the proportion of risky choices in the

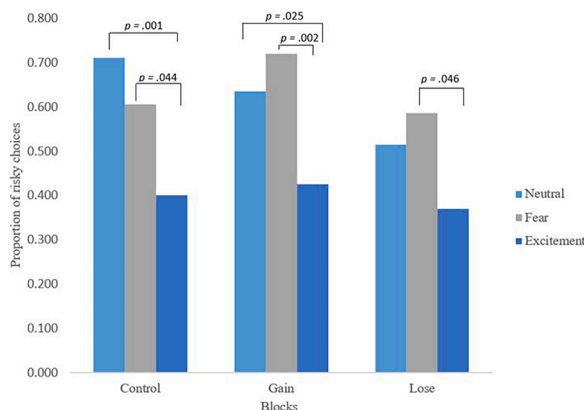


Fig. 3. Significant differences between Groups in the different blocks.

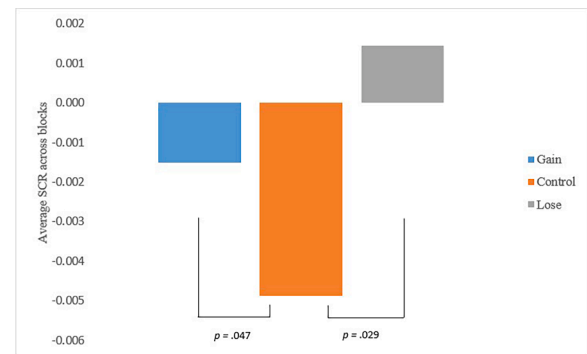


Fig. 4. SCR differences in the three blocks.

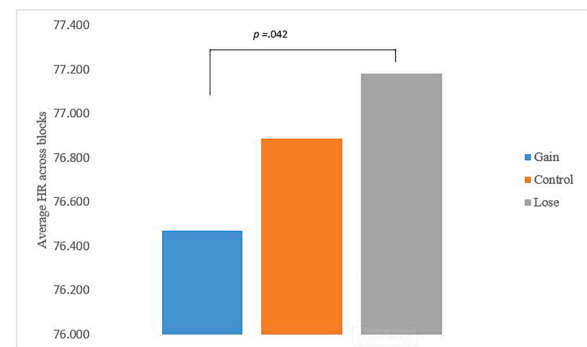


Fig. 5. HR differences in the three blocks.

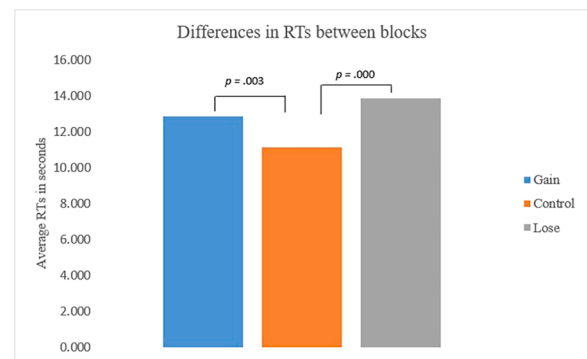


Fig. 6. Differences in RTs between the three blocks.

Control block does not differ from the Lose block. It seems that experiencing incidental fear tips over the probability of engaging in a risky behavior compared to RIs who are not induced with fear.

5.2. Limitations and future directions

The present research offers a novel insight on the interplay between cognitive biases triggered by external information and incidental emotions. The impact of incidental emotions on financial decision making seems to be strengthened by new experimental evidence, although, it seems obvious that specific incidental emotions (e.g., fear) do not always lead to a specific investment behavior (e.g., risk aversion) as different factors (e.g., cognitive biases) can completely change the direction of the investment preference. The novelty and the impact of the present study has important implications for future research, but its limitations must be noted as well. First, participants were asked to recall fearful or exciting events of their lives, and we then assumed that the emotions induced were fear and excitement. However, the specific intensity of

fear and excitement was not measured as the PANAS-X consists of positive and negative mood assessment items. Further research should measure the strength of the specific emotion experienced to understand the impact of the intensity (e.g., high, or low excitement) on the decision process. Second, the present findings suggested that the interaction between incidental emotions and cognitive biases moves investors away from optimal investment decisions. On the contrary, future research should investigate if the interaction between different incidental emotions, framing (and priming) effects can interact to produce more normative decisions in a specific investment context. Third, the prior sample size was calculated to find a main effect, however, a sample size of 60 participants can be considered underpowered for post hoc *t*-tests. Although the present research findings provide valuable insights into the relationship between biases, emotions, and investment behavior, further studies are needed to replicate these findings in order to increase their accuracy and reliability. To conclude, the present research demonstrated how risk seeking (and risk averse) behavior can be exacerbated in investment decisions, but there is still a great need to understand the cognitive and emotional factors that lead *expert* investors towards more “optimal” financial decisions rather than merely focusing on what leads *novice* investors towards risk seeking and risk adverse behavior.

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CRediT authorship contribution statement

Simona Cantarella: Conceptualization, Methodology, Writing – original draft, Writing – review & editing. **Carola Hillenbrand:** Conceptualization, Methodology, Writing – review & editing. **Chris Brooks:** Conceptualization, Methodology, Writing – review & editing.

Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on request.

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