MPRA

Munich Personal RePEc Archive

Incidental emotions and risk-taking: An experimental analysis

Annarita Colasante and Matteo M. Marini and Alberto Russo

Laboratori d'Economia Experimental, Universitat Jaume I, Castellon (Spain);, Department of Economics, Università degli Studi dell'Insubria, Varese (Italy);, Department of Management, Università Politecnica delle Marche, Ancona (Italy).

21 February 2017

Incidental emotions and risk-taking: An experimental analysis

Annarita Colasante[1], Matteo M. Marini[2], and Alberto Russo[*3]

[1]Laboratori d'Economia Experimental, Universitat Jaume I, Castellon, Spain
[2]Department of Economics, Università degli Studi dell'Insubria, Varese, Italy
[3]Department of Management, Università Politecnica delle Marche, Ancona, Italy

Abstract

In this paper we run a laboratory experiment in order to investigate the impact of incidental emotions on individual risk-taking. In particular, we induce sadness and happiness by means of audiovisual stimuli and compare the subsequent risky choices with the baseline thanks to a between-subjects design. A tweaked version of the Multiple Price List method is used to elicit individual risk preferences in the context of three different lotteries. As main result, the experimental subjects exhibit greater risk aversion under sadness or happiness, than under neutral conditions. Therefore, we explain the findings through the theory of ego depletion, whereby controlling emotions so as to subsequently process information consumes a limited self-regulatory resource, which is necessary to take risks as well. The outcome is detected in the first lottery but not from the second lottery onwards, probably due to unchecked order effect.

---

[*]Department of Management, Università Politecnica delle Marche, Piazzale Martelli 8, 60121 Ancona (Italy). E-mail: alberto.russo@univpm.it

1 Introduction

Nowadays, choice behavior is undoubtedly regarded as the fruit of two inter-
acting processes: the former more deliberative and rational, whereas the lat-
ter more impulsive and driven by emotions (Kahneman and Frederick (2002);
Loewenstein et al. (2015)). As far as risky decision making is concerned,
scholars have been mainly interested in modelling choice behavior by consid-
ering only the rational part of the story, such as in the case of the Expected
Utility Theory. However, in the last decades some elements belonging to the
affective sphere have been included thanks to Prospect Theory (Kahneman
and Tversky (1979); Tversky and Kahneman (1992)), like insensitivity to
probabilities and loss aversion. Within such a model, Brandstätter et al.
(2002) further tried to explain the inverse S-shape of the probability weight-
ing function as a result from anticipating emotion related to the future realiz-
ation of a risky payoff. Anyway, modelling emotions unrelated to the decision
at hand becomes even trickier, especially if we consider the disagreement of
the existing experimental literature about the effect of the specific type of
emotion on the behavioral outcome.

Thus, this paper aims at reaching a better understanding of how dis-
crete incidental emotions can influence risky decision making, given that
far-reaching implications for organizational contexts could derive from this
strand of literature: transient feelings are capable of directing the behavioral
outcome over time. Indeed, after a certain decision is made under the influ-
ence of emotion and this feeling vanishes, yet individuals keep on making new
choices consistent with the initial decision driven by the incidental emotion
(Andrade and Ariely, 2009).

In order to make a contribution to this burgeoning research branch, we
run a laboratory experiment where the participants undergo a so-called emo-
tion induction procedure that consists of an audiovisual stimulus triggering
sadness, happiness or neutral emotion. At this point, the players participate
in three different lottery-choice tasks structured according to the *Multiple
Price List* format (Binswanger, 1980), so that we can obtain a risk-taking
indicator of individual choices and detect possible emotional influence on
the basis of the between-subject design. By further enhancing the analysis

2

through an ordered logit model, we find that both sad and happy individuals are more risk-averse than those in a neutral mood. In the end, we speculate that the emotions experienced before the lotteries deplete the psychological resources required to take risks, in accordance with a past application of *ego depletion* theory (Unger and Stahlberg, 2011). The result is detected in the first lottery but vanishes from the second lottery onwards, presumably because of unchecked order effect. Since salient financial incentives are provided, finally each participant is paid according to the decisions made during the lottery-choice tasks.

The rest of the paper is organized as follows. Section 2 provides a discussion on the possible sources of disagreeement within the literature, by bringing up topics like the definition of emotion and the existing methods to elicit risk aversion. Section 3 describes the experimental design. The results are presented in Section 4, where, after checking for the effectiveness of the emotion induction procedure, we propose two analyses of risk behavior as well as discuss possible explanations. Section 5 concludes.

2 Kinds of affect and methods to elicit risk preferences

Since the last decade, the enigmatic relation between emotion and risk-taking has caught the attention of many scholars, especially in the field of Experimental Economics, and has been widely analyzed, leading some researchers to the formulation of two opposed theories: the Affect Infusion Model (AIM) (Forgas, 1995) and the Mood Maintenance Hypothesis (MMH) (Isen and Patrick, 1983). On the one hand, the former approach suggests that good mood brings to risk-seeking behavior, that is, people in a good mood perceive the risky choice as more favorable. At the same time, individuals in a bad mood prefer to stay conservative because they are pessimistic about risky outcomes. On the other hand, the latter thesis supports the opposite behavior, namely, subjects in a good mood are usually risk-averse because, in case they lose a gamble, they are going to lose not only the monetary amount, but also their positive emotion. Furthermore, people should strive

3

to change negative emotional state and take more risks. Having a look at the experimental evidence, we observe a really mixed context and findings at odds with each other: some authors, like Nygren et al. (1996) and Chou et al. (2007), encounter positive correlation between good mood and risk taking behavior; instead other works, like Chuang and Lin (2007) as well as Kliger and Levy (2003), show opposite results that support the MMH. Finally, it is not uncommon to come across intermediate conclusions, such as the case of Conte et al. (2016) who show that both positive and negative emotions increase the willingness to take risks, or Drichoutis and Nayga Jr (2013) reaching an opposite conclusion.

This conflicting evidence could be due to two main causes, that is, the difference in meaning between mood and emotion, and the various risk elicitation methods. Indeed, scholars have broadly used the terms *mood*, *emotion* and *affect* as synonyms, but there is a clear distinction as far as Psychology is concerned. According to Robbins and Judge (2012), *affect* defines a broad range of feelings that people experience, including both *emotion* as an intense short feeling coming from a specific stimulus, and *mood*, depicted as a less intense feeling which lasts for longer time. Anyway, since our experiment includes a multisensory stimulus, herein we focus on emotions.

Going through the research area of decision making under risk, the meaningful distinction between *anticipated or expected emotion* and *immediate emotion* is to be pointed out. As in Rick and Loewenstein (2008), the former refers to predictions about the emotion that agents will experience after knowing the outcome of their own choice, whereas the latter corresponds to the immediate reaction at the time of decision making, and in turn falls into one of two categories. Indeed, even if connected with the consequences of one's decision, *integral emotion* is experienced at the time of decision making and provides individuals with more thorough information about their own tastes. Finally, *incidental emotion* is felt during decision making but totally unrelated to the choice at hand, and represents the object of this paper.

Furthermore, connected with the issue of the definition, it has been shown that different emotions with the same *valence* (i.e., with the same emotional sign) trigger different risky behaviors. For example, Raghunathan and Pham (1999) and Lerner and Keltner (2001) show that fear, anger and sadness, usu-

ally all classified as "negative emotion", impinge differently on risk aversion with respect to each other. Accordingly, in order to avoid typical ambiguity of the valence-based approach (Zeelenberg and Pieters, 2006), in the current work we prefer to focus on specific feelings, that is, sadness and happiness.

The second reason why the previous literature disagrees could be associated with the different experimental methodologies used for eliciting individual risk aversion. In accordance with Charness et al. (2013), we can cite among them:

- The *Balloon Analogue Risk Task* (BART) (Lejuez et al., 2002). In this kind of experiment the only task is to pump a series of virtual balls. For each pump the participant wins 5 cents in a temporary account and, at whatever moment of game, she can decide to move the amount in a permanent account. In this case a new small ball appears. Instead, if the balloon bursts before moving the money, then the player loses the amount in the temporary account and a new balloon appears. On the one hand, the larger becomes the ball, the higher is the amount in the temporary account; on the other hand, the burst probability increases with the dimension of the ball. The measure of risk aversion is the adjusted number of pumps, whereby a high number of pumps denotes risk-seeking behavior.

- The *Gneezy and Potters Method* (Gneezy and Potters, 1997). In this game players receive a certain amount and have to decide how much to invest in a risky option which offers a certain dividend. The difference between the initial amount and the investment in the risky choice is kept by the player. The higher the investment, the lower the risk aversion level.

- The *Multiple Price List Method* (MPL) (Binswanger, 1980). The task consists in choosing within a list of paired lotteries, where each choice of the list usually includes a safe lottery and a risky gamble. Therefore, players choose the preferred option for each row, and the sum of safe choices in each list is used as rough measure of risk aversion. The main feature of this method is that each choice is associated with a

specific coefficient of relative risk aversion, which is computed under the assumption of a specific form of the utility function, namely, preferences are modeled according to a Constant Relative Risk Aversion utility function (CRRA).

Since this is merely an exemplifying list, we refer the reader to Andersen et al. (2006) for a review of the most relevant risk elicitation methods.

To sum up, studies grounded on different kinds of affect or different risk elicitation methods have led to dissimilar findings, and comparisons among them are questionable as well.

Therefore, some caveats about these two features are necessary before moving on. Even though for the sake of simplicity we are going to employ the terms *emotion* and *mood* without distinction throughout the paper, we are actually interested in understanding the impact of incidental sadness and happiness on risk aversion, by using a MPL method to elicit risk preferences[1].

3 Experimental design

We conduct four different treatments in four different sessions, following the same scheme in each one: (i) a first stage in which, after a brief socioeconomic questionnaire is filled in, we convey a specific audiovisual stimulus and check for its efficacy, (ii) a second stage in which the participants make risky choices by using our version of the *Multiple Price List* method.

Since we are interested in analyzing the effect of different kinds of emotion on risk aversion, we use the audiovisual stimulus as control variable and employ four treatments that can be distinguished just on the basis of it. According to the existing literature, several techniques are suitable to elicit a specific emotion, as Westermann et al. (1996) also highlighted. Indeed, each mood induction procedure can be classified as *simple* if only one of the techniques is used, or *combined* in case more techniques are implemented together. Following some useful advice (Mayer et al., 1995), we combine two of the eleven existent methods, namely, images in addition to music, in

---

[1]In the same way, for the sake of simplicity we are going to alternate the adjective *happy* with *positive/good*, as well as *sad* with *negative/bad*.

order to avoid ineffective induction procedures. In particular, referring to the communicative theory of emotions (Johnson-Laird and Oatley, 2008), we assume that only four *basic emotions* (happiness, sadness, anxiety and anger) can be evoked through music. Therefore, we focus on sadness and happiness in addition to two control treatments, selecting musical pieces which are supposed to induce negative, positive or neutral conditions; moreover, we choose sad, happy or neutral pictures to be shown during the listening phase of the respective treatments, in order to enhance the wished emotions.

Therefore, we run four different sessions:

- the *N-treatment* (negative treatment), in which the participants listen to few minutes of the musical piece "Polymorphia" by Penderecki accompanied by negative images, so that they can experience sadness;

- the *P-treatment* (positive treatment) in which we select Bernstein's track "Mambo" and some positive pictures, in order to induce happiness;

- the *CS-treatment* (control treatment with audiovisual stimulus), in which we propose an excerpt from the neutral piece "Symphony n.40" by Mozart[2] in addition to a few neutral images; and finally

- the *C-treatment* (control treatment), without music or pictures.

In the following sections, sometimes we will cluster the observations coming from the *N-treatment* and the *P-treatment*, and refer to them as *Emotional treatments*. In the same way, we will name *Baseline* the data combined from the *CS-treatment* and the *C-treatment*.
A summary of the whole mood induction procedure is shown in Table 1, whereas a description of the manipulation check is contained in subsection 4.1.

Moving to the second phase, the risk aversion elicitation task consists of three lotteries based on a MPL method similar to that one proposed by Abdellaoui (2000), Ding et al. (2010) and Abdellaoui et al. (2011), namely,

---

[2]This piece of music is contained in a list of pieces that Västfjäll (2002) judges to be suitable for neutral conditions.

Table 1: Treatments

	Emotional Treatments		Baseline	
	N-treatment	P-treatment	CS-treatment	C-treatment
Participants	35	30	30	28
Emotion	Negative	Positive	Neutral	Neutral
Stimulus	yes	yes	yes	no

a list in which players can choose ten times either a risky option (i.e., a fixed probability to win an amount of money), or a safe amount. The main difference between our game and Holt and Laury (2002)'s version lies in the fact that Holt and Laury considered a list of paired risky options, as shown in Table 2. Indeed, in that case the safe choice is represented by Option A, whose payoffs are less variable than Option B but still risky.

The MPL method is one of the most used formats to elicit individual risk aversion, and its pros and cons are highlighted by Andersen et al. (2006). His popularity is due to simplicity of the structure and the possibility to gather lots of observations and pay just one of the choices by random selection, without decreasing the salience of payments (Laury, 2005). Going back to Table 2, by the last row any subject should cross over to Option B, thereby making manifest her own risk preferences. In contrast, the main disadvantage of this format arises from the occurence of multiple switch points, which according to Charness et al. (2013) could be due to misunderstanding of the instructions and, accordingly, seen as *inconsistent behavior*.[3]Andersen et al. (2006), instead, argue that such a conduct can be considered as indifference between choices. All in all, since in our setting we include an explicit choice for indifference between the safe and the risky choices (i.e., a specific row of the table where to cross over to the other option) and we still observe inconsistent choices, the occurrence of multiple switch points is probably due to lack of attention or scarce comprehension of the instructions. However,

---

[3]For example, Jacobson and Petrie (2009) in a field experiment found 55% of inconsistent choices.

Table 2: Ten paired lottery proposed by Holt and Laury (2002)

Nr.	Option A		Option B	
1	$p = 1/10$ of 2.00,	$p = 9/10$ of 1.60	$p = 1/10$ of 3.85,	$p = 9/10$ of 0.10
2	$p = 2/10$ of 2.00,	$p = 8/10$ of 1.60	$p = 2/10$ of 3.85,	$p = 8/10$ of 0.10
3	$p = 3/10$ of 2.00,	$p = 7/10$ of 1.60	$p = 3/10$ of 3.85,	$p = 7/10$ of 0.10
4	$p = 4/10$ of 2.00,	$p = 6/10$ of 1.60	$p = 4/10$ of 3.85,	$p = 6/10$ of 0.10
5	$p = 5/10$ of 2.00,	$p = 5/10$ of 1.60	$p = 5/10$ of 3.85,	$p = 5/10$ of 0.10
6	$p = 6/10$ of 2.00,	$p = 4/10$ of 1.60	$p = 6/10$ of 3.85,	$p = 4/10$ of 0.10
7	$p = 7/10$ of 2.00,	$p = 3/10$ of 1.60	$p = 7/10$ of 3.85,	$p = 3/10$ of 0.10
8	$p = 8/10$ of 2.00,	$p = 2/10$ of 1.60	$p = 8/10$ of 3.85,	$p = 2/10$ of 0.10
9	$p = 9/10$ of 2.00,	$p = 1/10$ of 1.60	$p = 9/10$ of 3.85,	$p = 1/10$ of 0.10
10	$p = 10/10$ of 2.00,	$p = 0/10$ of 1.60	$p = 10/10$ of 3.85,	$p = 0/10$ of 0.10

as far as our analysis is concerned, the issue of multiple switch points is not relevant, as we are going to clarify in Section 4.

Our three lotteries, whose specifications are shown respectively in Table 3, Table 4 and Table 5, have the following peculiarities:

- Lottery 1: the safe choices (*Option A*) range from 100 to 190, while the amount and the win probability of the risky choices (*Option B*) are constant.

- Lottery 2: the safe choices (*Option A*) are constant and equal to 100, whereas the win probability of the risky choices (*Option B*) gradually increases from 0.1 to 1.

- Lottery 3: whilst the safe choices (*Option A*) are represented by a constant loss equal to -20, the risky choices (*Option B*) involve increasing probability to lose 100.

Therefore, for the sake of simplicity we call *Option A* and *Option B* the choices in all the three lotteries and, concerning the risky options, we always impose the choice between a risky amount of money and zero to make the

Table 3: Lottery 1

Choice number	Option A	Option B	
		$p = 1/2$	$p = 1/2$
1	100	of 300,	of 0
2	110	of 300,	of 0
3	120	of 300,	of 0
4	130	of 300,	of 0
5	140	of 300,	of 0
6	150	of 300,	of 0
7	160	of 300,	of 0
8	170	of 300,	of 0
9	180	of 300,	of 0
10	190	of 300,	of 0

game as clear as possible and avoid misunderstandings, as implemented in Plott and Zeiler (2005) and Shupp et al. (2013).

Table 3 shows the lottery in which we vary the riskless amount and fix the gamble: we expect that a risk neutral person will choose *Option B* six times before switching to *Option A*.

Table 4 shows the lottery in which we fix the amount of the safe choice, while the probability to win the gamble changes: here we expect that a risk neutral person will choose *Option A* four times before switching to *Option B*.

Table 5, finally, shows the lottery defined in the loss domain: players have to choose between a small sure loss and a risky option in which it is possible not to lose anything. In this case, we expect that a risk neutral person will choose *Option B* two times before switching to *Option A*.

The experiment was conducted in May 2014 in the Laboratory of the Faculty of Economics "Giorgio Fuà", Università Politecnica delle Marche (Ancona, Italy) and involved 123 participants (59 females). Having randomly assigned the participants to one of the four sessions, we read aloud the instructions at the beginning of each turn and then players took their

Table 4: Lottery 2

Choice number	Option A	Option B	
1	100	$p = 1/10$ of 250,	$p = 9/10$ of 0
2	100	$p = 2/10$ of 250,	$p = 8/10$ of 0
3	100	$p = 3/10$ of 250,	$p = 7/10$ of 0
4	100	$p = 4/10$ of 250,	$p = 6/10$ of 0
5	100	$p = 5/10$ of 250,	$p = 5/10$ of 0
6	100	$p = 6/10$ of 250,	$p = 4/10$ of 0
7	100	$p = 7/10$ of 250,	$p = 3/10$ of 0
8	100	$p = 8/10$ of 250,	$p = 2/10$ of 0
9	100	$p = 9/10$ of 250,	$p = 1/10$ of 0
10	100	$p = 10/10$ of 250,	$p = 0/10$ of 0

Table 5: Lottery 3

Choice number	Option A	Option B	
1	-20	$p = 1/10$ of -100,	$p = 9/10$ of 0
2	-20	$p = 2/10$ of -100,	$p = 8/10$ of 0
3	-20	$p = 3/10$ of -100,	$p = 7/10$ of 0
4	-20	$p = 4/10$ of -100,	$p = 6/10$ of 0
5	-20	$p = 5/10$ of -100,	$p = 5/10$ of 0
6	-20	$p = 6/10$ of -100,	$p = 4/10$ of 0
7	-20	$p = 7/10$ of -100,	$p = 3/10$ of 0
8	-20	$p = 8/10$ of -100,	$p = 2/10$ of 0
9	-20	$p = 9/10$ of -100,	$p = 1/10$ of 0
10	-20	$p = 10/10$ of -100,	$p = 0/10$ of 0

place in the cubicle. After starting the game, the participants read again the instructions in their own screen, filled in the questionnaire and were invited to put on the headphones to get involved in the feeling suggested by music and images. Since salient financial incentives were provided, in the end the players were paid according to the decisions made during the lottery-choice tasks, in order to increase the incentive to behave correctly and reveal true preferences. Indeed, regarding each participant we randomly drew one of her choices in each lottery and paid her in accordance with the sum of these values. The experiment lasted about 40 minutes and the average payment amounted to 8 euro, including a show-up fee of 3 euro.

4 Results

In this section we are going to show and comment on the results of the experiment. Firstly, we test the efficacy of the mood induction procedure. Secondly, the data related to each lottery are analyzed by using the individual number of risky choices as risk-taking indicator. Thirdly, we rely on the ordered logit model as suitable tool for enhancing the study. Finally, a general discussion is provided to shed light on possible explanations.

4.1 Manipulation check

Before moving to the results, a few issues have to be clarified.

Throghout the paper, (i) we always combine the data from the *CS-treatment* and the *C-treatment*, assuming that they both fostered neutral conditions. At the same time, (ii) we hypothesize that the *N-treatment* induced sadness, whereas the *P-treatment* elicited happiness.

In order to test such hypotheses, immediately after the audiovisual stimulus and before Lottery 1 we asked players to report a self-evaluation of their own emotion by using a 6-point Likert scale (Matell and Jacoby, 1971) and a series of adjectives.

Table 6 shows that the adjectives were different on the basis of the treatment. Indeed, in the *N-treatment* we asked about only negative feelings, whereas in the *P-treatment* we used just positive adjectives. In this way,

Table 6: Mood questions after the stimulus

	Emotional Treatments		Baseline	
	N-treatment	P-treatment	CS-treatment	C-treatment
How much are you ..... from 0 to 5?	Sad Worried Scared Doubtful	Happy Carefree Serene Determined	Sad Happy	Sad Happy

we wanted to enhance the impact of music and pictures as well as we were able to avoid experimenter demand effects (Zizzo, 2010), since it is not intuitive what risky decisions good (or bad) mood should trigger. In other words, the emotion measurement itself was part of the induction procedure, but preserved validity because at the same time let individuals not give false answers, as in Campos-Vazquez and Cuilty (2014).

Anyway, this design allows us to compare the responses related to sadness and happiness, that are object feelings of study.

By so doing, in Figure 1 we easily see that the procedure of clustering both the control treatments under the label *Baseline* is validated, because no differences in moods were found.[4]

Furthermore, the boxplot in Figure 2 suggests that players in the *N-treatment* were actually sadder than those in the *Baseline*. At the same time, individuals in the *P-treatment* seem to be happier than those in the *Baseline*. This impression is supported by the Wilcoxon rank sum test in Table 7.

Therefore, we theorize that the emotion induction procedure was successful and the behavioral outcomes in subsections 4.2 and 4.3 are due to the different emotions experienced at the time of decision making.

---

[4]Comparing the *CS-treatment* and the *C-treatment* by means of Wilcoxon rank sum test, neither the intensity of sadness ($z = 0.60$, p-value= 0.55) nor the degree of happiness ($z = 0.20$, p-value= 0.84) were significantly different.
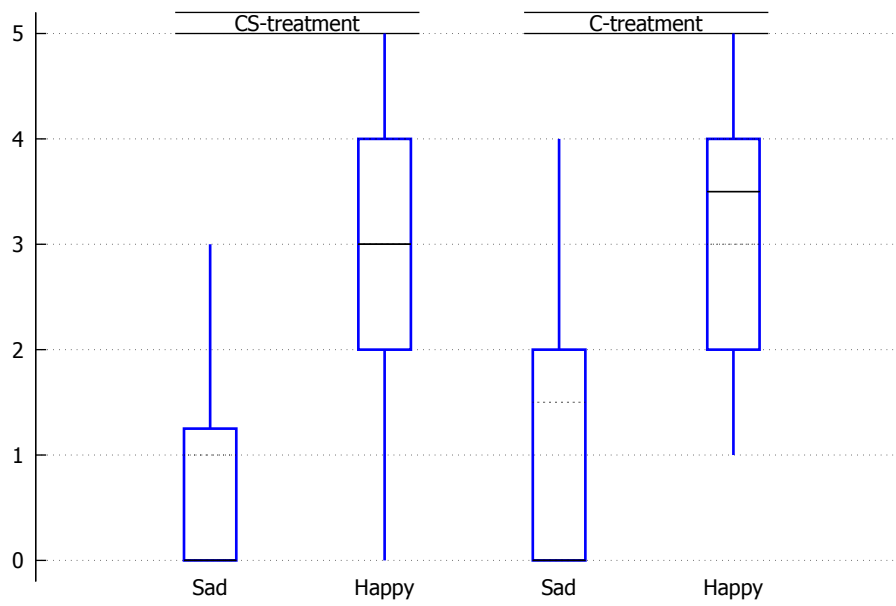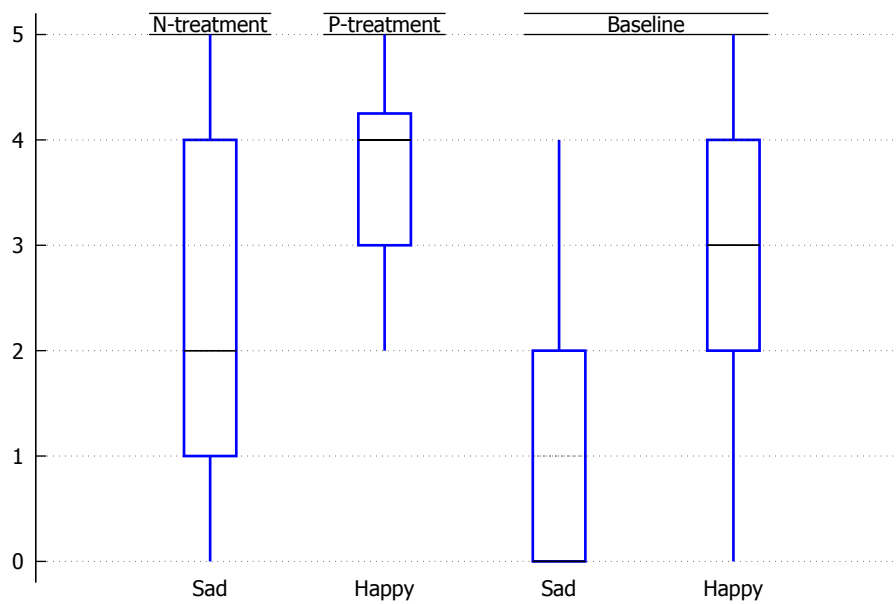
Figure 1: Intensity of moods in the control treatments

Figure 2: Intensity of moods

Table 7: Comparison of inducted moods distributions

	Nonparametric test	
	N-treatment vs Baseline*	P-treatment vs Baseline**
Wilcoxon	z= 4.17	z= 2.23
p-value	(0.00)	(0.02)

*Sadness is compared.
**Happiness is compared.

4.2 The individual number of risky choices as risk-taking indicator

As stated in Section 3, in this phase of the experiment we use a tweaked version of the MPL format due to its simplicity and appropriateness for eliciting individual risk preferences. When highlighting the pros and cons of this approach, Andersen et al. (2006) stress the understandability of the structure as well as its flexibility to incentives as main advantages, whereas they indicate the possibility of multiple switch points as chief drawback. On the one hand, the same authors argue that this kind of behavior can be seen as indifference between choices, but on the other hand Charness et al. (2013) suggest that the occurrence of multiple switch points is due to misunderstanding of the instructions.

As said before, since in our design we include an explicit choice for indifference between the safe and the risky choices (i.e., a specific row of the table where to cross over to the other option) and we still observe inconsistent choices, our conclusion is that the inconsistent behavior is arguably due to lack of attention or scarce comprehension of the instructions. Indeed, if we pool all the observations, in the first lottery 49 out of 123 subjects (39.84%) make inconsistent choices, but the trend decreases to 19 participants (15.45%) in the second lottery and 33 individuals (26.83%) in the third one, thanks to the learning effect. This evidence is highlighted in Figure 3, where the proportion of inconsistent subjects is represented by the dark blue bars.

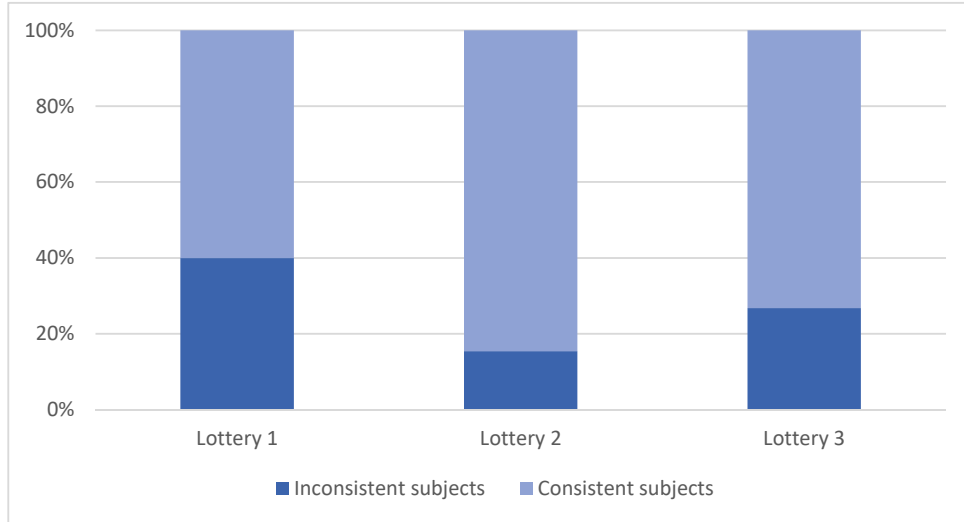Anyway, in our case the issue of multiple switch points is not relevant,

Figure 3: Proportion of inconsistent subjects in each lottery

since the total number of safe (risky) choices within a single lottery can be used as individual risk aversion (risk-taking) indicator, as Holt and Laury (2002) point out.

Focusing on the first lottery, we remind the reader that the probability of winning the risky option is held constant and equal to 50%, while the amount of the safe option gradually increases from 100 to 190. Therefore, a risk neutral person is expected to choose *Option B* six times, before switching to *Option A*.

In Figure 4, we show the proportion of risky choices made by the players in each decision. Having drawn a grey line to indicate the prediction under the hypothesis of risk neutrality, the percentage of risky choices falls very quickly after the fifth choice both in the *N-treatment* and in the *P-treatment*. Whereas, in the *Baseline* more than 30% of the participants still prefer the risky option until the last choice.

Since the players in a neutral mood seem to be more risk lover than the others, such a result could suggest that the induction of positive or negative
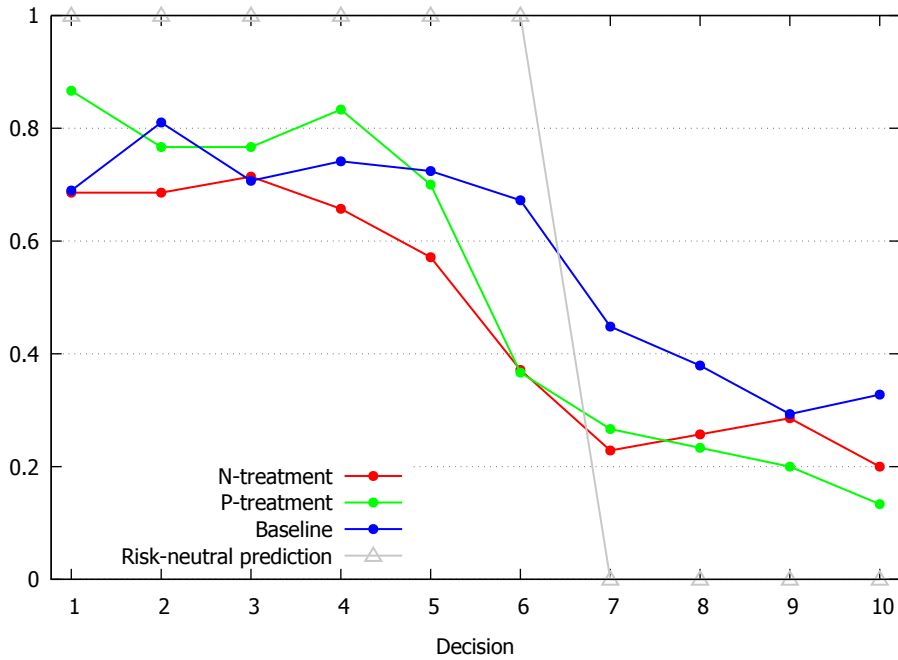
16

Figure 4: Proportion of risky choices in each decision - Lottery 1

emotions increased risk aversion.

In order to check if our graphical analysis is significant, we compare our treatments with respect to the individual number of risky choices by running the Wilcoxon rank sum test, whose results are shown in Table 8 together with the summary statistics. The nonparametric test rejects the null hypothesis, underlining that the participants in a positive or negative mood are actually more risk averse than the individuals in a neutral mood.

Furthermore, no noteworthy results come out of the comparison between the *N-treatment* and the *P-treatment*.[5]

The second lottery differs from the previous one with respect to two peculiarities: in this case the amount of the safe option is held constant and equal to 100, while the probability of winning the risky option increases from 0.1 to 1. Moreover, the risk-neutral prediction involves going for the safe option four times, before switching to the risky one.

---

[5]We check if the difference between the risky choices in the *Emotional treatments* is significant, but the Wilcoxon rank sum test is not able to reject the null hypothesis ($z = 1.25$; p-value $= 0.21$).

Table 8: Comparison of risky choices distributions - Lottery 1

	Summary statistics		
	N-treatment	P-treatment	Baseline
Mean	4.66	5.13	5.79
Median	5	5	6
Standard deviation	1.71	1.59	2.21

	Nonparametric test	
	N-treatment vs Baseline	P-treatment vs Baseline
Wilcoxon	z= -2.96	z= -1.88
p-value	(0.00)	(0.05)
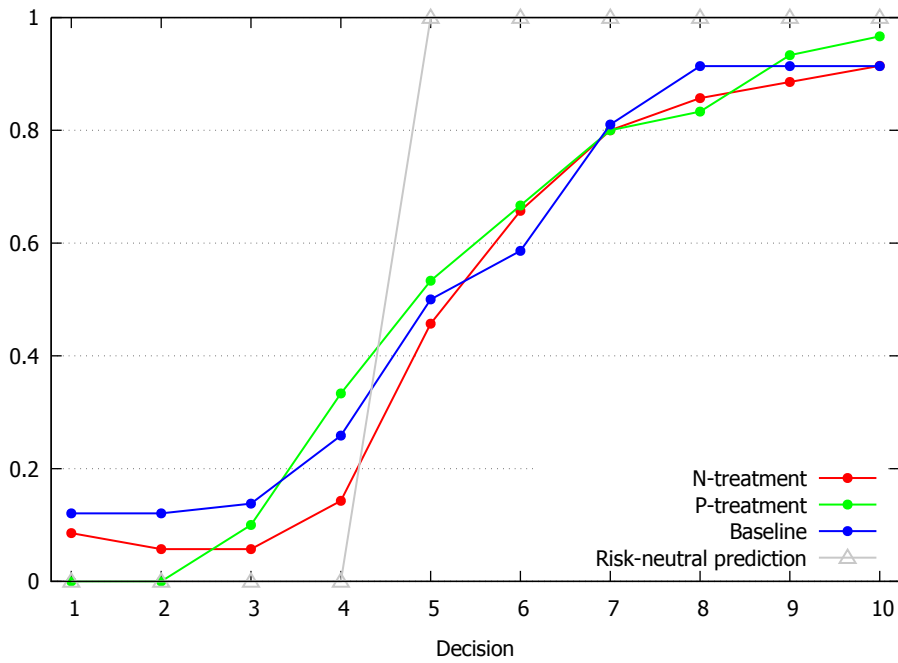
Figure 5: Proportion of risky choices in each decision - Lottery 2

18

Table 9: Comparison of risky choices distributions - Lottery 2

	Summary statistics		
	N-treatment	P-treatment	Baseline
Mean	4.91	5.17	5.28
Median	5	5	5.5
Standard deviation	1.40	1.51	1.93

	Nonparametric test	
	N-treatment vs Baseline	P-treatment vs Baseline
Wilcoxon	z= -0.95	z= -0.25
p-value	(0.34)	(0.81)

Taking into account these modifications, in Figure 5 we illustrate the risky choices made by players in each decision. This time, at first sight nothing can be said about potential divergent patterns of behavior among treatments, since no line seems to stand out from the maze. Such an impression is confirmed by the Wilcoxon rank sum test in Table 9, where we also display the summary statistics and find no differences between groups.[6]

Finally, the third lottery is defined in the loss domain: the amount corresponding to the safe option is fixed and equal to -20, whereas the probability of losing money in the risky option gradually increases from 0.1 to 1. This time, any risk-neutral subject is expected to choose *Option B* twice, before crossing over to *Option A*.

As we see in Figure 6, the relative trend of risk choices is quite similar to the previous lottery despite the different framework, in the sense that the proportion of risky choices in each decision falls in a homogeneous way, and does not seem to be affected by the specific emotional state. The insight is demonstrated in Table 10, where we fail to reject the null hypothesis of significantly different distributions.[7]

---

[6]No difference is also detected between the two *Emotional treatments* (z = 0.53; p-value = 0.59).

[7]In the same way, also in this case the two *Emotional treatments* do not significantly
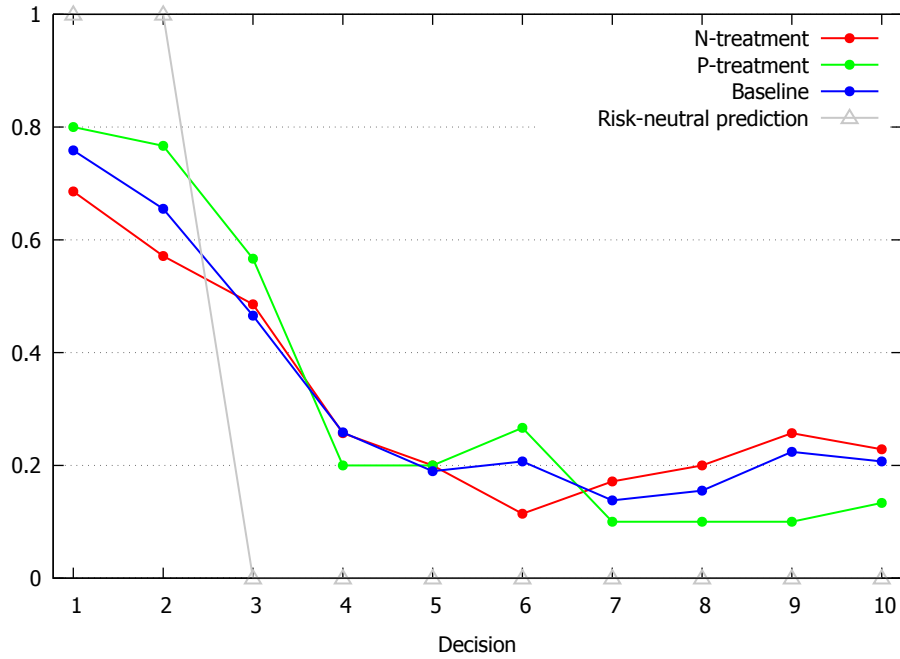
Figure 6: Proportion of risky choices in each decision - Lottery 3

Table 10: Comparison of risky choices distributions - Lottery 3

	Summary statistics		
	N-treatment	P-treatment	Baseline
Mean	3.17	3.23	3.26
Median	3	3	3
Standard deviation	1.67	1.52	1.90

	Nonparametric test	
	N-treatment vs Baseline	P-treatment vs Baseline
Wilcoxon	z= 0.14	z= 0.18
p-value	(0.89)	(0.86)

Table 11: Comparison of invested sum distributions

	Summary statistics		
	N-treatment	P-treatment	Baseline
Mean	160.66	152.60	221.33
Median	80	80	100
Standard deviation	217.68	213.11	276.44

	Nonparametric test		
	N-treatm vs Baseline	P-treatm vs Baseline	N-treatm vs P-treatm
Wilcoxon	z= -0.98	z= -0.86	z= 0.05
p-value	(0.33)	(0.39)	(0.96)

Summing up, in Lottery 1 both participants in a good mood and subjects in a bad mood were more risk averse than people in a neutral mood, but this evidence disappeared from Lottery 2 onwards.

In order to understand whether our findings can actually be attributed to the emotions experienced, we rely on the initial questionnaire and check for the risk preferences that we had elicited before the mood induction procedure through the following question:

- "You are given the opportunity to buy a financial product which with the same probability allows you to win 1000 euro or to lose the invested sum. How much are you willing to pay for such a financial product?"

As depicted in Table 11, when we compare the answers to the question by treatment, the Wilcoxon rank sum test finds no differences between groups: the subjects in the *Emotional treatments* seem to be initially as risk-averse as the players in the *Baseline*, unlike results in Lottery 1. This fact enhances the results of the study.

---

differ in the risk-taking indicator (z = -0.04; p-value = 0.97).

4.3   The ordered logit model

As further proof in favour of the previous findings, in this subsection we include the ordered logit model as appropriate tool to describe our data. Indeed, for each lottery we cumulate all the 123 observations, thereby obtaining three models. In each of them, the dependent variable is represented by:

- our *Risk-taking indicator*, which consists of a sum of risky choices ranging from 0 to 10. Therefore, it is a discrete ordinal variable whereby we assume that higher values correspond to higher risk-seeking. This measurement is carried out after the mood induction procedure, if any.

Moreover, we include the following variables as regressors:

- *Emotions*: it is a dummy assuming the value of 1, in case the subject belongs to either the *N-treatment* or the *P-treatment*. Otherwise it is equal to 0, denoting neutral emotion. In this way, we equalize both the individuals in a good mood and the players in a bad mood, following the results in subsection 4.2. Therefore, our hypothesis is that such a variable is statistically significant in Lottery 1, but not from Lottery 2 onwards.

- *Invested sum*: it is a continuous variable displaying the answer to the risk-related question that we reported in the previous subsection. That question, contained in the initial socioeconomic questionnaire, aimed at measuring risk aversion before the mood induction procedure. Therefore, by including this variable in the model, we try to isolate the effect of *Emotions* from the individual endowment of risk aversion.

- *Female*: it is a dummy equal to 1 in case gender is feminine, and 0 otherwise. In this way, we control any possible gender effect on the dependent variable.

In Table 12 we calculate the coefficients via maximum likelihood estimation (MLE) for all the three lotteries.

In Lottery 1, the negative coefficient of the variable *Emotions* means that the fact of participating in either the *N-treatment* or the *P-treatment* involves

Table 12: Ordered logit models

Dependent variable: Risk-taking indicator

	Lottery 1	Lottery 2	Lottery 3
Emotions	-0.967***	-0.193	0.248
	(0.342)	(0.327)	(0.328)
Invested sum	0.001	0.001*	0.002***
	(0.001)	(0.001)	(0.001)
Female	-0.047	-0.522	0.892***
	(0.324)	(0.326)	(0.334)
Observations	123	123	123
Log-likelihood	-239.643	-225.429	-226.2066
LR test	$\chi^2(3) = 51.86$	$\chi^2(3) = 50.23$	$\chi^2(3) = 51.46$
p-value	(0.00)	(0.00)	(0.00)

    ***Significant at the 1 percent level
    **Significant at the 5 percent level
    *Significant at the 10 percent level

lower *Risk-taking indicator*, that is, it makes the subject more risk-averse. The related significance at the 1 percent level leads us to conclude that the previous findings are confirmed. Indeed, neither Lottery 2 nor Lottery 3 displays significance of *Emotions*.

As additional result, it comes out that in Lottery 3, when it is possible to make a loss, females want to avoid safe losses at all costs and accordingly take more risks. In this final lottery, the behavioral outcome is driven by the initial willingness to gamble, rather than the emotions experienced.[8]

4.4 Discussion

At this point, solid ground is present to visualize how sadness and happiness impacted on risk-taking. Accordingly, we search for possible explanations:

- on the one hand, the Affect Infusion Model (AIM) (Forgas, 1995) is

---

[8]This could be ascribed to the very definition of emotion as temporary feeling, but more research is needed to prove this speculation.

consistent with pronounced risk aversion of sad individuals, but fails to account for similar risk attitude of happy subjects;

- on the other hand, the Mood Maintenance Hypothesis (MMH) (Isen and Patrick, 1983) justifies caution shown by players in a good mood, but is not consistent with the reduced risks taken under the influence of sadness.

Clearly, these two theories do not explain our data, and it is necessary to look for alternative explanations.

Therefore, we theorize that the phenomenon known as *ego depletion* (Baumeister et al., 1998) played a crucial role during risky decision making. According to this theory, controlling emotions and processing information are only two of some activities consuming a limited self-regulatory resource, which can be seen as kind of energy. Once this resource is even partly used, subsequent performance on self-control-related tasks will be undermined.

Concerning the consequences on risky decision making, we follow the approach proposed by Unger and Stahlberg (2011), whereby two types of risk behavior should be distinguished. If the decision task is represented by a gamble without perceived control over the final outcomes, like in the case of playing roulette, then ego depletion conditions are expected to increase risk-taking. Whereas, if the task at hand is embodied by a responsible economic decision involving the selection of several options different with respect to outcome probabilities and payoffs, then ego depletion leads to risk aversion. However, both the negative and the positive potential consequences of the decision have to materialize immediately, and not only in the distant future. Otherwise, reduced self-control fosters risk-seeking behavior like in the case of smoking, whose negative effects arise after ages but emotional rewards are instantaneous.

Relying on these arguments, we think that our experimental subjects employed their own self-regulatory resources in order to control bad or good emotions and participate in the subsequent three lotteries. Since these lotteries did not demand the simple decision of participating or not, but entailed reasoning about outcome probabilities and payoffs, we conclude that ego depletion caused risk aversion.

Indeed, according to Fischer et al. (2007) subjects under ego depletion become less optimistic about their own chances. The authors show that the construction of positive views of the self requires the same above-mentioned self-regulatory resource, because such positive illusions can need "activities such as defending own standpoints, biased memory encoding and retrieval, suppression of threatening information, or selective devaluation of self-inconsistent evidence"(Fischer et al., 2007, p. 1307). Therefore, lack of optimism triggered by ego depletion could further explain the greater risk aversion observed in the *Emotional treatments* in Lottery 1.

Finally, as far as the different findings in Lottery 2 and Lottery 3 are concerned, we speculate that possible order effects represent the limit of this investigation, and could have influenced the final outcomes. Indeed, our design confounded order and treatment effects because all the three lotteries were always carried out in the same order, making arduous any possible interpretation.

Also for this reason, supplementary investigations are desirable to corroborate the fascinating ego-depletion story.

5 Conclusions

In this paper we ran a laboratory experiment in order to investigate the effect of incidental emotions on individual risk-taking. In particular, we tested in a controlled environment the potential of audiovisual stimuli to induce sad, happy or neutral emotions that, in turn, could affect individual behavior when the subjects were supposed to make risky choices. A modified version of the well-known *Multiple Price List* (Binswanger, 1980) method was used in order to elicit individual risk preferences by means of three different lotteries.

The main finding of the study is that individuals in the *N-treatment* (negative treatment) and in the *P-treatment* (positive treatment) were more risk averse than those in the *Baseline*. This comes out of two different analyses: the former was based on the individual number of risky choices as risk-taking indicator, whereas the latter focused on the ordered logit model as appropriate econometric tool. We theorize that both sad and happy players were affected by the phenomenon known as *ego depletion* (Baumeister et al., 1998),

which could have led them to greater risk-averse behavior through less optimistic expectations about the future (Fischer et al., 2007). The result is detected in the first lottery but vanishes from the second lottery onwards, presumably due to unchecked order effect.

In any case, these findings add new empirical evidence to a literature which is still in its infancy, given that the two chief psychological theories of emotions and risk-taking (AIM and MMH) are not supported. Definitely, additional research is needed to have a firm grasp of the role of emotions in risky decision making.

Acknowledgments

References

Abdellaoui, M. (2000). Parameter-free elicitation of utility and probability weighting functions. *Management Science*, 46(11):1497–1512.

Abdellaoui, M., Driouchi, A., and L´ Haridon, O. (2011). Risk aversion elicitation: reconciling tractability and bias minimization. *Theory and Decision*, 71(1):63–80.

Andersen, S., Harrison, G. W., Lau, M. I., and Rutström, E. E. (2006). Elicitation using multiple price list formats. *Experimental Economics*, 9(4):383–405.

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

Baumeister, R. F., Bratlavsky, E., Muraven, M., and Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, 74(5):1252–1265.

Binswanger, H. P. (1980). Attitudes toward risk: Experimental measurement in rural india. *American journal of agricultural economics*, 62(3):395–407.

Brandstätter, E., Kühberger, A., and Schneider, F. (2002). A cognitive-emotional account of the shape of the probability weighting function. *Journal of Behavioral Decision Making*, 15(2):79–100.

Campos-Vazquez, R. M. and Cuilty, E. (2014). The role of emotions on risk aversion: a prospect theory experiment. *Journal of Behavioral and Experimental Economics*, 50:1–9.

Charness, G., Gneezy, U., and Imas, A. (2013). Experimental methods: Eliciting risk preferences. *Journal of Economic Behavior & Organization*, 87:43–51.

Chou, K.-L., Lee, T., and Ho, A. H. (2007). Does mood state change risk taking tendency in older adults? *Psychology and aging*, 22(2):310.

Chuang, S.-C. and Lin, H.-M. (2007). The effect of induced positive and negative emotion and openess-to-feeling in student's consumer decision making. *Journal of Business and Psychology*, 22(1):65–78.

Conte, A., Levati, M. V., and Nardi, C. (2016). Risk preferences and the role of emotions. *Economica*, forthcoming.

Ding, X., Hartog, J., and Sun, Y. (2010). Can we measure individual risk attitudes in a survey? Technical report, Tinbergen Institute Discussion Paper.

Drichoutis, A. C. and Nayga Jr, R. M. (2013). Eliciting risk and time preferences under induced mood states. *The Journal of Socio-Economics*, 45:18–27.

Fischer, P., Greitemeyer, T., and Frey, D. (2007). Ego depletion and positive illusions: Does the construction of positivity require regulatory resources? *Personality and Social Psychology Bulletin*, 33(9):1306–1321.

Forgas, J. P. (1995). Mood and judgment: the affect infusion model (aim). *Psychological bulletin*, 117(1):39.

Gneezy, U. and Potters, J. (1997). An experiment on risk taking and evaluation periods. *The Quarterly Journal of Economics*, pages 631–645.

Holt, C. A. and Laury, S. K. (2002). Risk aversion and incentive effects. *American economic review*, 92(5):1644–1655.

Isen, A. M. and Patrick, R. (1983). The effect of positive feelings on risk taking: When the chips are down. *Organizational Behavior and Human Performance*, 31(2):194–202.

Jacobson, S. and Petrie, R. (2009). Learning from mistakes: What do inconsistent choices over risk tell us? *Journal of Risk and Uncertainty*, 38(2):143–158.

Johnson-Laird, P. N. and Oatley, K. (2008). Emotions, music, and literature. In Lewis, M., Haviland-Jones, J. M., and Barrett, L. F., editors, *Handbook of emotions 3rd Edition*. The Guilford Press.

Kahneman, D. and Frederick, S. (2002). Representativeness revisited: Attribute substitution in intuitive judgment. In Gilovich, T., Griffin, D., and Kahneman, D., editors, *Heuristics & biases: The psychology of intuitive judgment*. New York: Cambridge University Press.

Kahneman, D. and Tversky, A. (1979). Prospect theory: an analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, 47(2):263–292.

Kliger, D. and Levy, O. (2003). Mood-induced variation in risk preferences. *Journal of economic behavior & organization*, 52(4):573–584.

Laury, S. K. (2005). Pay one or pay all: Random selection of one choice for payment. *Working Paper 06-13, Andrew Young School of Policy Studies, Georgia State University*.

Lejuez, C., Read, J. P., Kahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., Strong, D. R., and Brown, R. A. (2002). Evaluation of a behavioral measure of risk taking: the balloon analogue risk task (bart). *Journal of Experimental Psychology: Applied*, 8(2):75–84.

Lerner, J. S. and Keltner, D. (2001). Fear, anger, and risk. *Journal of personality and social psychology*, 81(1):146.

Loewenstein, G., O'Donoghue, T., and Bhatia, S. (2015). Modeling the interplay between affect and deliberation. *Decision*, 2(2):55–81.

Matell, M. and Jacoby, J. (1971). Is there an optimal number of alternatives for likert scale items? *Educational and Psychological Measurement*, 31:657–674.

Mayer, J. D., Allen, I. P., and Beauregard, K. (1995). Mood inductions for four specific moods: A procedure employing guided imagery. *Journal of Mental imagery*, 19(1-2):133–150.

Nygren, T. E., Isen, A. M., Taylor, P. J., and Dulin, J. (1996). The influence of positive affect on the decision rule in risk situations: Focus on outcome (and especially avoidance of loss) rather than probability. *Organizational Behavior and Human Decision Processes*, 66(1):59–72.

Plott, C. R. and Zeiler, K. (2005). The willingness to pay–willingness to accept gap, the. *The American Economic Review*, 95(3):530–545.

Raghunathan, R. and Pham, M. T. (1999). All negative moods are not equal: Motivational influences of anxiety and sadness on decision making. *Organizational behavior and human decision processes*, 79(1):56–77.

Rick, S. and Loewenstein, G. (2008). The role of emotion in economic behavior. In Lewis, M., Haviland-Jones, J. M., and Barrett, L. F., editors, *Handbook of emotions 3rd Edition*. The Guilford Press.

Robbins, S. P. and Judge, T. A. (2012). Emotions and moods. In Robbins, S. P. and Judge, T. A., editors, *Organizational Behavior 15th Edition*. Prentice Hall.

Shupp, R., Sheremeta, R. M., Schmidt, D., and Walker, J. (2013). Resource allocation contests: Experimental evidence. *Journal of Economic Psychology*, 39:257–267.

Tversky, A. and Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty*, 5(4):297–323.

Unger, A. and Stahlberg, D. (2011). Ego-depletion and risk behavior: Too exhausted to take a risk. *Social Psychology*, 42(1):28–38.

Västfjäll, D. (2002). Emotion induction through music: A review of the musical mood induction procedure. *Musicae Scientiae*, Special issue 2001-2002:173–211.

Westermann, R., Spies, K., Stahl, G., and Hesse, F. W. (1996). Relative effectiveness and validity of mood induction procedures: A meta-analysis. *European Journal of Social Psychology*, 26(4):557–580.

Zeelenberg, M. and Pieters, R. (2006). Feeling is for doing: A pragmatic approach to the study of emotions in economic behavior. In DeCremer, D., Zeelenberg, M., and Murnighan, J. K., editors, *Social psychology and economics*. Mahwah, NJ: Erlbaum.

Zizzo, D. J. (2010). Experimenter demand effects in economic experiments. *Experimental Economics*, 13:75–98.