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Anticipated regret and self-esteem in the Allais paradox

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Regret anticipé et estime de soi dans le paradoxe d'Allais

Résumé

L'article étudie l'impact de l'estime de soi sur les choix risqués dans le paradoxe d'Allais à partir d'un protocole expérimental sur l'Internet. Une explication de l'effet de certitude basée sur le regret anticipé implique que l'estime de soi soit une variable déterminante du choix entre les options, mais uniquement lorsque celui-ci porte sur un gain certain ou un gain risqué. Nous supposons que les participants dont l'estime de soi est faible choisiront plus fréquemment l'option sûre (plutôt que l'option risquée) que ceux dont l'estime est élevée, tandis qu'aucune différence n'apparaîtra concernant l'estime de soi lors du choix entre deux options risquées. Les données expérimentales confirment cette hypothèse. Nous observons également que les hommes et les étudiants en économie se conforment plus fréquemment à la théorie de l'espérance d'utilité que les femmes et les autres étudiants en sciences sociales respectivement. Nous discutons enfin des implications de ces résultats pour la théorie économique du regret. Une théorie plus complète de la prise de décision risquée devrait prendre en compte les motivations ainsi que les caractéristiques psychologiques des individus.

Mots-clés : Paradoxe d'Allais ; Risque ; Aversion au regret ; Estime de soi ; Internet ; Genre

Anticipated regret and self-esteem in the Allais paradox

Abstract

Our experiment aims at studying the impact of self-esteem on risk-prone choices in an Allais-type decision context using hypothetical money. We use an Internet protocol in order to reach a large heterogeneous student population sample. An anticipated regret explanation for the certainty effect implies that self-esteem is a crucial psychological variable in what concerns risky decision, but only when the choice is between a safe option and a risky option. Thus, in our experiment, we hypothesize that low self-esteem people will choose more frequently the safe option (rather than the risky-prone option) than high self-esteem people, whereas low self-esteem and high self-esteem individuals will show the same pattern of choices between two different risk-based options. Our data confirm our hypothesis. Regarding risky choices preferences, we also observe that females, non economists and older people significantly exhibit safer choice preferences than other participants. We find also that men and students in economics are more likely to conform to expected utility theory than females and other social science students respectively. We then discuss what these findings mean for economic regret theory, and suggest that a complete theory of decision-making under risk should introduce both situational and motivational explanations of individual behaviour.

Keywords: Allais paradox; Risk; Regret aversion; Self-esteem; Internet experiment; Gender differences

JEL: C91; D81

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1. Introduction

In his famous paradox for decision under risk, Allais (1953) asked students how they would choose between two hypothetical options A and B:

A: certainty of 1 million francs

B: 1/100 chance of nothing
89/100 chance of 1 million francs
10/100 chance of 5 million francs

After they completed this decision, students were then asked how they would choose between option C and option D:

C: 89/100 chance of nothing
11/100 chance of 1 million francs

D: 90/100 chance of nothing
10/100 chance of 5 million francs

There are four ways of answering the two questions: AC, AD, BC, and BD. Among the four possibilities, AC and BD are consistent with expected utility theory (von Neumann and Morgenstern, 1944) whereas AD and BC are not consistent. Kahneman and Tversky (1979) have established experimentally that many people prefer the combination of A and D, i.e. that they have Allais preferences (see Camerer, 1995, for a review). One explanation for this result can be found in the “*certainty effect*”. In the choice between A and B, people must sacrifice a guarantee of one million francs – a 100 percent chance – for an option in which they might win more, but might win nothing at all. In the choice between C and D, however, there is no guaranteed win; instead, people must sacrifice a small, 11 percent chance of winning one million francs for only a slightly smaller, 10 percent chance of winning much more. A possible psychological process that may underlie the certainty effect is *anticipated regret* (Bell, 1982, 1983; Loomes and Sugden, 1985). “Regret is the emotion that we experience when realizing or imagining that our current situation would have been better, if only we had decided differently.” (Zeelenberg and Pieters, 2007) When making decisions, people often anticipate the emotions they might experience as a result of the outcomes of their choices (Mellers and McGraw, 2001). Economic regret theory assumes that individuals are regret averse and, as a consequence, motivated to avoid, or at least to reduce or minimize, regret. In the Allais paradox, an anticipated regret explanation for the certainty effect implies that people consider the safe option A as the regret-minimizing option and the risky option as the regret-maximizing one. However, let us imagine people who choose option A and subsequently learn that they could have won 5 million francs by choosing option B: what would be the extent of regret they felt? how much regret would they feel? In this case, expectation of the full feedback of the foregone option and anticipated regret would probably push them towards risk seeking (option B).

As pointed out by Bell (1983) and stressed by several subsequent experimental studies (Josephs et al., 1992; Larrick and Boles, 1995; Zeelenberg et al., 1996; Coricelli et al., 2007; van de Ven and Zeelenberg, 2011), this above-mentioned example suggests that the anticipation of some feedback is probably necessary for anticipated regret to influence decisions. In particular, Josephs and his colleagues (1992) examined the effect of anticipated feedback on risky decision-making in a situation of asymmetric feedback between a small certain payoff and an uncertain payoff. In their experiment, increased risk-aversion was found, but only for low self-esteem participants who were told that they would learn the outcomes of each decision they made (Feedback condition). The authors contended that people with low self-esteem are more vulnerable to threats to their self-image and are more likely to make choices that minimize the possibility of regret in order to protect their self-esteem.

In our experiment, we propose a new regret-based test of the Allais paradox which focuses on the role of self-esteem. In the Allais paradox, the situation of asymmetric feedback concerning the foregone alternative between a sure thing and a risky option is a main characteristic of the gambling task. Specifically, choice between options A and B displays this asymmetry, whereas it is absent in choice between options C and D. Indeed, the outcome of the certain option A is, by definition, known in advance. Thus, by choosing this safe option, people can avoid outcome feedback on the risky option and, consequently, regret. On the contrary, by choosing the risky option B, people run the risk of experiencing regret if the choice leads to a bad outcome because they always know what they would have obtained if they had chosen the safe option. Thus, choosing the safe option A prevents people having feedback on what might have been, whereas the risky option B provides this information, and consequently, carries the risk of regret. Therefore, in the choice between options A and B, anticipated regret should promote risk aversion (the choice of A over B). However, no regret effects can be expected between the choices of C over D since the two options give a small comparable chance of winning a huge amount of money. Now, if the desire to maintain self-esteem leads people to minimize anticipated regret, then this should show up in a strong preference for option A over option B, but in indifference between options C and D. An anticipated regret explanation for the certainty effect would thus imply that self-esteem is a crucial psychological variable regarding risky decision, but only for the choice between the safe option A and the risky option B. In our experiment, we thus hypothesize that low self-esteem people will choose the safe option A (rather than option B) more frequently than high self-esteem people, and that low self-esteem and high self-esteem individuals will show the same pattern of choices for the options C and D.

2. Experimental Design

2.1 Internet procedure

Our experimental objective was to study the impact of self-esteem on risky decisions in a hypothetical framework. We run an Internet experiment which provides a relatively inexpensive way of reaching a large subject pool (Anderhub, Müller and Schmidt, 2001). Decision making at one's own PC at home or in the office is probably a more natural setting than that in the laboratory. The procedure is thus more convenient and is probably well adapted to the use of the "strategy method" (Selten, 1987): participants are simply asked to indicate how they would choose between different risky choices.

2.2 Participants

Almost sixteen thousands e-mails were sent to students at their electronic mail address at a French University, asking them to participate to an economic study. Volunteer participants to the study consisted of nine hundred and thirty eight undergraduate and postgraduate students from a wide range of disciplines (Law, Economics, Education Sciences and Politics). Data from one subject were discarded for internal inconsistent psychological measure. Nine hundred and thirty seven participants remained.

On the first page of the Internet protocol, it was explained that the study was a research on individual financial decision-making and that all personal data was strictly confidential, anonymous, and secure. We used a very simple HTML format which gave the used-interface an academic look and sense. No monetary payment was offered to the participants in the present study. However, volunteer participants could participate to a lottery which enabled them to win little gifts.

2.3 Self-Esteem Scale

We used five items of the Rosenberg Self-Esteem Scale (RSES) and five items of the State Self-Esteem Scale (SSES; Heatherton and Polivy, 1991). The Rosenberg Self-Esteem Scale was designed as a unidimensional self-report measure of feelings of global self-esteem in individuals (Rosenberg, 1965) and is the most widely used measure of global self-esteem. The State Self-Esteem Scale is a commonly used measure that is able to measure momentary fluctuations of self-esteem. A five-point response format was used for the ten items: 1=strongly disagree, 2=disagree, 3=agree, 4=strongly agree, 5=totally agree. The negatively worded items are reverse scored. The scores for each item are summed, giving a total score range from 10 to 50, with higher scores signifying higher self-esteem.

2.4 Main task: an Allais-type decision context with hypothetical money

Regret can occur when people compare reality to imagined alternatives (Sugden, 1985). So, subjects were asked to *imagine* that they are an individual looking for profit maximization while making risky financial decisions. They were then asked how they would choose between two hypothetical options A (1, 1 million euros) and B (0.89, 1 million euros; 0.10, 5 millions euros; 0.01, 0). After they completed this decision, subjects were asked how they would choose between option C (0.89, 0; 0.11, 1 million euros) and option D (0.90, 0; 0.10, 5 millions euros). No feedback was provided to participants after they made their choices.

3. Results

3.1 Population sample descriptive statistics

Six hundred and eleven participants were females, whereas three hundred and twenty-six were males (35%). The mean age is 22.7 (SD = 4.3). Our population sample was composed of law students (38%), economics students (22%), education sciences students (19%), politic students (12%), and students belonging to other departments (8%).

3.2 Self-Esteem Scale

Descriptive statistics for self-esteem are the following. The internal consistency for the sample in this study is satisfactory (Cronbach's $\alpha = .85$); the mean score is 32.1 out a maximum of 50 and a minimum of 10 (SD = 7.2). There is a significant main effect of gender on self-esteem, with males having higher self-esteem than women¹: men show a significant higher mean (34.6, SD = 6.6) than women on the self-esteem scale (30.9, SD = 7.2), $t(935) = -7.9$, $p < 0.01$.

3.3 The Allais paradox

As shown previously, choices pattern AC and BD counted as confirmations of expected utility (EU), while AD and BC counted as violations. Table 1 below shows typical Allais paradox results²: (1) four hundred and eighty-seven participants (52%) violated expected utility; (2) among them, four hundred and twenty-four demonstrated preference pattern AD (87.1%). Interestingly, choices preferences showed gender differences, which are illustrated in Figures 1a and 1b below.

¹ Gender differences in global self-esteem are often observed: in a meta-analysis of 216 effect sizes from 184 studies, Kling, Hyde, Showers and Buswell (1999) found a small overall effect size favouring males ($d=0.21$).

² Experimental results from Conlisk (1989, p. 395, Table 1) are used to serve as a comparison: AC (7.6%), AD (43.6%), BC (6.8%), and BD (41.9%).

**Table 1 - Quantitative results from the test of the Allais Paradox
(Number of participants and proportion(% in brackets))**

Options	A	B	Total
C	167 (17.8%)	63 (6.7%)	230 (24.5%)
D	424 (45.3%)	283 (30.2%)	707 (75.5%)
Total	591 (63.1%)	346 (36.9%)	937

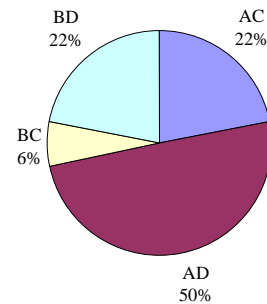
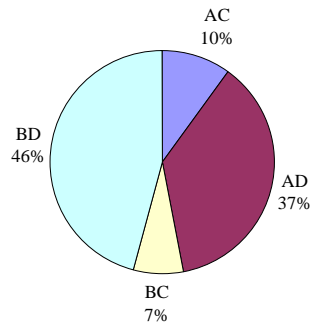


Fig 1.a: Male participants choice pattern in the Allais paradox

Fig 1.b: Female participants choice pattern in the Allais paradox

From Figures 1a and 1b, we observe that female choices pattern were significantly different from male choices pattern ($\chi^2(3) = 64.6, p < 0.01$) and that males were more likely to conform to expected utility preferences (56%) than females (44%) ($\chi^2(1) = 11.7, p < 0.01$). We also found that economics students are more likely to choose EU options than other social students (58% compared with 45%, $\chi^2(1) = 10.1, p < 0.01$). Interestingly, undergraduate economists choose more frequently EU options than postgraduates economists (65% compared with 51%, $\chi^2(1) = 3.90, p < 0.05$).

3.4 Certainty effect

Five hundred and ninety-one participants chose the safe option A (63.1%) rather than the risky option B. Based on their self-esteem score, subjects were divided by median split into high self-esteem and low self-esteem groups (median score = 33). We used this split to compare high and low self-esteem risky gambling decisions (Figures 2a and 2b).

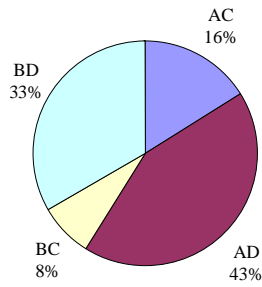


Fig 2.a: High Self-Esteem participants choice pattern in the Allais paradox

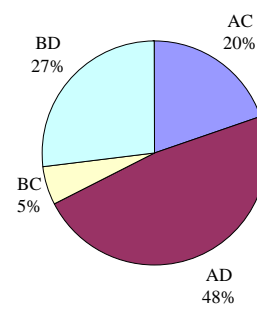


Fig 2.b: Low Self-Esteem participants choice pattern in the Allais paradox

We observed that high self-esteem participants chose significantly more frequently the risky option B (over to option A) than low self-esteem people (41% compared with 32%, $\chi^2(1) = 7.1$, $p < 0.01$). However, the proportion choosing option C (over option D) was almost identical between low self-esteem and high self-esteem subjects (24% compared with 25%, $\chi^2(1) = 0.15$, ns). The percentage of choices conformed to EU is also similar for high and low self-esteem groups (49% compared with 47%, $\chi^2(1) = 0.52$, ns).

We also found that female subjects were 25% more likely to choose the safe option A (over to option B) than were male participants ($\chi^2(1) = 54.9$, $p < 0.01$). Female participants also chose significantly more frequently the less risky option C (over to option D) than males (28% compared to 17%, $\chi^2(1) = 12.9$, $p < 0.01$).

We then used a Binary Logit Model (see Kennedy, 2003) to study more precisely the variables that differentiate the safe option A from the risky option B. The factors that determine the likelihood a participant will choose the risky option B are divided into the demographic (age and gender), psychological (self-esteem) and education (disciplines and grade levels) variables. Table 2 summarizes the empirical findings. In the estimation, the main representative qualitative categories – law students and undergraduate participants – were coded as reference variables.

Table 2 - Estimated coefficients of the Binary Logit Model (A vs. B)

Variables	Coefficient	Std Error	z-value	Marginal Effect (%)
Age	-0.038	0.021	0.070	-0.9
Gender	0.893	0.155	0.001	20.9
Self-Esteem	0.020	0.010	0.054	0.5
Postgraduate	-0.132	0.164	0.419	-3.1
Economics	0.313	0.187	0.094	7.3
Political Sciences	0.072	0.233	0.756	1.6
Educational Sciences	-0.657	0.240	0.006	-14.1
Other Departments	0.117	0.348	0.737	2.7

Number of observations: 937; $pseudo-R^2$: 0.071, chi-squared: 87.07 ($p < 0.001$)

On using the Binary Logit Model, the estimates show that five variables (Age, Gender, Self-Esteem, Economics and Educational Sciences) are significant in explaining the likelihood that a subject will choose the risky option rather than the safe one. The direction of the relationship

between gender and self-esteem and our qualitative dependent variable (A vs. B) is consistent with our previous statistical analysis: high self-esteem people and males were significantly more willing to choose the risky option B than low self-esteem people ($p < 0.10$) and than females ($p < 0.01$) respectively. We also remark that economics students chose less frequently the safe option than law students ($p < 0.10$) and that, on the contrary, education sciences students showed significantly greater risk aversion ($p < 0.01$). Finally, stronger risky behaviour seemed to be associated to younger people rather than older ones ($p < 0.10$).

In the last column of Table 2, we computed the partial derivative of the Logit equation in order to obtain the change in the expected value of our dependant variable (A vs. B) caused by a one unit increase in each explanatory variable, holding constant the other independent variables in the equation. These marginal effects enabled us to precise the intensity of the impact of each explanatory variable on the certainty effect. We observed that the probability of a male rather than a female participant choosing the risky option B raises by 20.9 percent (other things equal). An increase in ten points of the self-esteem individual score causes a 5 percent increase of the probability that the participant will choose the risky option rather than the safe one. We also observed that an economics student is more likely to show higher risk aversion (+ 7.3%), while taking option B, than a law student. On the contrary, the expected probability that an education sciences student chooses the risky option falls by 14% compared with a law student. A ten-year older participant is also significantly more likely to show less risk aversion (-8.8%).

3.5 Expected utility versus Allais preference patterns

Using a Binary Logit equation, we also studied the variables that differentiate conformed expected utility choice patterns (AC and BD) from non-conformed choice preferences (AD and BC). Estimations results are reported in Table 3.

Table 3 - Estimated coefficients of the Binary Logit Model (EU vs. non-conformed EU choices)

Variables	Coefficient	Std Error	z-value	Marginal Effect (%)
Age	0.019	0.019	0.325	0.5
Gender	-0.401	0.150	0.008	-9.9
Self-Esteem	0.003	0.009	0.784	0.7
Postgraduate	-0.037	0.153	0.807	-0.9
Economics	-0.331	0.182	0.069	-8.3
Political Sciences	0.099	0.223	0.658	2.4
Educational Sciences	0.439	0.210	0.036	10.8
Other Departments	0.116	0.332	0.726	2.9

Number of observations: 937; *pseudo-R*²: 0.024, chi-squared: 31.26 ($p < 0.001$)

We found that Gender, Economics and Educational Sciences, were significant, at a 10 percent level, in explaining the likelihood that a subject will choose EU options (AC and BD) rather than non expected utility options (AD and BC). In particular, we observed that the probability that a male rather than a female will conform to EU theory is 9.9 percent higher ($p < 0.01$). An economics student is also more likely to conform to rational theory as compared to a law student (+8.3%). On the contrary, an education sciences student is more likely to choose non-conformed choice patterns rather than a law student (+10.8%). Self-esteem scores and age were not found significant in explaining EU versus non EU patterns.

4. Discussion and conclusion

4.1 Self-esteem and certainty effect

Our experiment aimed at examining the impact of self-esteem on risky choices in an Allais-type decision context with hypothetical money. We hypothesized that self-esteem would be a crucial psychological variable explaining the certainty effect in the Allais paradox. Our findings confirmed our hypothesis and indicated that low self-esteem people were significantly more likely to choose the safe option A rather than the risky option B than high self-esteem people. On the opposite, we found no difference between low and high self-esteem people for the choices between options C and D. Low self-esteem people may avoid risk more than high self-esteem people because the cost of losing a gamble may be higher for a low self-esteem people, as they have fewer self-evaluative resources to counter such a threat (Josephs et al., 1992). In the hypothetical Allais gambling task, the threat arises from the expected regret associated with choosing the uncertain payoff (option B) and anticipating that the option will not pay off. In this situation, subjects will have to recognize that a poor decision was made since one million euros was available for sure. However, the threat that one's choices will not pay off may have different effects on high and low self-esteem people. High self-esteem people should be able to withstand this threat, because they can counter it with many aspects of their self-image. Therefore, they may view a risky decision as an opportunity for a large payoff, or even as a challenging situation, rather than as a threat to self-esteem. Low self-esteem people, on the other hand, have fewer self-evaluative resources to dispel such a threat. The threat will consequently imply greater costs for low self-esteem people. In particular, the fictitious loss of one million euros may reaffirm low self-esteem individuals' sense of themselves as incompetent losers. Consequently, low self-esteem people are likely to make choices that minimize the possibility of regret as a means of protecting their self-esteem.

4.2 Gender and education differences in risky choice

Regarding risky choices preferences, we observed that females, non economists and older people significantly exhibited safer choice preferences than other participants. We also found that men and students in economics were more eager to conform to expected utility theory than females and other social sciences students respectively. Some other studies have already shown that economics students behave in more self-interested ways than non economists in cooperative economic games and that this difference might result from training in economics (Frank, Gilovich and Regan, 1993). To our knowledge, our experiment is the first to point out that these behavioural differences can also appear in risky decisions. We also found that conformed expected utility patterns were more frequently observed for undergraduates rather than postgraduates economics students, suggesting that behavioural differences between social sciences students might be explained by a selection effect (Frey and Meier, 2003). Similarly, several experimental studies observed that women are more risk-averse than men (see Croson and Gneezy, 2009, for a review). However, while gender differences in risk preferences are relatively consistent, very few explanations are offered for the observed differences. Our findings suggest that a possible reason for the observed risk pattern difference is based upon the role of anticipated regret and self-protection motivation. According to Arch (1993), for example, males are more likely to view a risky situation as a challenge that calls for participation, while females interpret risky situations as threats that encourage avoidance.

4.3 Implications for economic regret theory

Economic regret theory does not give explanations for why people would exhibit specific attitudes about risk or regret aversion or why there would be differences among people (Leland,

2010). Economic regret models still treat risk preference or regret aversion as just other preferences which psychological origins are unquestioned. In line with economic regret theory, however, our experiment supports the claim that people anticipate potential emotional consequences of a decision and, consequently, behave in a way to defend themselves against them. Our results also suggest that personality factors, such as self-esteem, and gender differences may lead to systematic differences in individual's sensitivity to feeling regret (Schwartz et al., 2002), which in turn may affect risky decision in a hypothetical context. By incorporating affective and motivational determinants into an expected utility framework, economic regret theory has the potential for taking into account individuals' differences in risky behaviour theory. Economic regret theory suggests that people are both willing to maximize their expected outcomes and to protect their self-image when they are making a decision. Consequently, if we assume that situational and personality factors are crucial determinants of our need for self-protection, a complete theory of decision making under risk should introduce both situational and motivational explanations of individual behaviour.

4.4 Conclusion

In our experiment, we found that self-esteem was an important psychological variable explaining the certainty effect in the hypothetical Allais gambling task. The current study also showed gender as well as education behavioural differences regarding risky decisions in the Allais paradox.

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