Risk aversion and Incoherence bias:

Distortion between Sequential and Simultaneous Responses

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Abstract

Consistent behaviours are a fundamental requirement of Expected Utility Theory (EUT). Individual's decisions in non-strategic experiments should not be sensitive to the way experiments are framed. In the context of a random lottery procedure, subjects adhering to EUT should consider questions separately instead of regarding questions as a whole experience, which entails the best strategy to win. Hey and Lee (2005) argued that "If the subjects consider the questions as a whole , their best response to an individual question may not be the same response as would be given if the experiment consisted of just that one question". Subsequently, subject's responses will suffer from a kind of inconsistency due to the incoherence of preferences. This paper presents a new evidence of the role of framing in the context of a lottery-choice experiment, using Holt and Laury (2002)'s elicitation method as a baseline treatment. We check for incoherence biases, more especially non-stochastic preferences, by running several treatments in which we varied the order of the decisions (simultaneous or sequential presentation of the same paired lotteries) and the way the probabilities are ranged (in an increasing, decreasing or random manner). Our results indicate that framing affects both the level of inconsistencies and risk aversion. In particular, we find that the frequency of switching, more than once, to the riskier option increases when questions are presented sequentially. This inconsistency tends to disappear either when questions are simultaneous and/or when probabilities are ranged according to the original experiment (i.e in an increasing manner). We also ran additional treatments with higher payoffs, and observe a dramatic decrease of inconsistent behaviour when incentives are more salient. Consequently, we conclude that incentives matter in eliciting true and consistent preferences, since the magnitude of gain enhance performance and reduce incoherent behaviours. Finally, our results show that the probability of choosing the safer option is also significantly influenced by framing. Individuals are more likely to choose the safer option when lotteries are presented sequentially or/and when probabilities are ranged in a random or in a decreasing manner.

Keywords: risk aversion, lottery choice experiment, coherence, framing effect

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1- Introduction

Individual risk preferences are a fundamental block of economic analysis. Given the fact that many economic models are predicted under the existence of risk aversion, and so modelled upon the validity of expected utility theory, it is important to establish the robustness of EU in predicting individual behaviour over different elicitation schemes. Expected utility theory imposes, through its axioms, conditions of coherence, rationality, and consistency on the beliefs ascribed. Because coherence and consistency are ultimate requirements of rationality, it is obvious that one should guarantee that preferences under consideration cohere with theses requirements. Expected Utility axioms have been challenged experimentally displaying various choice anomalies. For that reason, inconsistent behaviour requires a fastidious scrutiny.

Authors are generally interested in the violation of independence axiom, in explaining the famous Allais paradox (1953), and assume that coherence axiom (we refer to transitivity) is a fundamental component of rationality that is irrevocable. Psychologists were more realistic and showed that coherence can be defied by what we call "*preference reversal*". Afterwards, numerous studies point out the effect of the frame on the adherence of subjects to expected utility axioms. It was extensively proven that people are very sensitive to the way a problem is presented. We elucidate below that these studies were especially concentrated on two distinct contexts: eliciting preferences and inducing preferences[1]. Behaviour is automatically influenced by the procedure employed, and violations of maximisation requirements are exaggerated by the change of frame[2].

This current study focuses on a simpler frame effect, i.e. the way of presenting lottery-choice in the context of the *lottery random procedure* elicited by Holt and Laury (2002). The authors argue that resulting decisions from this procedure are stable over probability range. Authors asserted that subjects switched only once from the safe option to the risky option, over the ten paired lotteries. We find this affirmation, although its accordance with coherent behaviour, very strong because decisions among a large number of choice tasks imply necessary errors. When errors are random, the decision procedure is able to elicit preferences in accordance to rational requirements, and

[1]Allais paradox is; also, strongly due to the frame of questions (see Conlisk (1989)), but our study do not focus on that aspect of that anomaly.

[2] It is argued that the complexity of questions alters the consistency of behaviour, especially in the case of the "common consequence effect" and the "common ratio effect.

individuals are EUT maximizers[3]. Meanwhile, errors are not allowed by EU theoretical framework. Further, errors may be non-random which complicate the understanding of human rationality.

The aims of this paper are threefold. First, we examine the conditions in which framing may affect the consistency of the decisions. Second, we examine to what extent increasing payoffs may tend to reduce inconsistencies. Third, we seek to investigate to what extent slight changes in context may alter the apparent risk aversion that people reveal.

For this purpose, we examine the distortion between the simultaneous lottery-choice procedure implemented by Holt and Laury (2002) which involve perfect information with lotteries ranged from 10 to 100%, and a sequential lottery-choice procedure in which we also change the range of probabilities (in a random manner, in an decreasing manner). By introspection, we think that sequential responses are less coherent than simultaneous responses. Indeed we conjecture that *sequentiality,* by providing less information about the whole game would raise the probability of errors. Accordingly, we assume that subjects will exhibit more inconsistent choices in sequential treatments compared to simultaneous treatments this statement, if it occurs, would show that individuals do not regard paired lotteries as separate questions, and prove that the frame of the original experience is established judiciously in order to avoid such bias. Moreover, we expect incoherence to be more frequent when lotteries are ranged in a random order instead of an increasing order. Indeed, we assume that the framing of probability matters when subjects reveals their preferences and that random probability would intensify the frequency of inconsistent behaviour because paired lotteries are not presented in a monotonic manner. Finally, we conjecture that framing may also affect the attitude of subjects toward risk. Indeed, we postulate that framing may have a direct impact on this probability, by inducing for example a lower level of information about all relevant alternatives in the game. Framing may also indirectly influence the proportion of safe choices because of a higher level of induced inconsistencies.

To address this, we examine treatments where lottery choices are either presented simultaneously or sequentially and/or probabilities are ranged from 10 to 100%, 100% to 10% or randomly ranged. We also investigate whether the stake size matters and affects the consistency of the

[3] Starmer and Sugden (1991) argued that "we may allow for a stochastic element in choice by saying that if an individual has a true preferences for x over y he will chose x in real-choice experiment unless he makes mistakes and by assuming that mistakes are random" pp 972

decisions. As we know from Holt and Laury, increasing payoffs significantly influence decision toward risk since a higher part of subjects tend to be more risk averse under a high payoff condition. However, we assume that increasing payoffs may also influence behaviours by reducing significantly the level of inconsistencies. The idea is that individuals would pay more attention to each decision and would therefore make less error when payoffs in stake are higher.
Our results are broadly consistent with the framing hypothesises. We find that the frequency of switching, more than once, to the riskier option increases when questions are presented sequentially. This inconsistency tends to disappear when questions are simultaneous. Our results also indicate that salient incentives induce a dramatic decrease of inconsistent behaviour. Finally, our results show that the probability of choosing the safer option is also significantly affected by framing. Individuals are more likely to choose the safer option when lotteries are presented sequentially or/and when probabilities are ranged in a random manner.

The remainder of this paper is organized as follows. Section 2 presents a review of literature summarizing the relevant previous researches. Our experimental design is presented in more detail in section 3. Section 4 presents and interprets the results of the experiment. Finally section 5 summarizes and concludes.

2- A review of literature and motivations:

2.1. Choices anomalies and violation of expected utility axiom

Choices anomalies have become the most attractive field of decision theory since the discovery of systematic violations of expected utility axioms in laboratory experiments. The Allais paradox (1953) is the most famous systematic violation of the independence axiom of expected utility theory. Although the common-consequence (Allais (1953)) and the common-ratio (Kahneman and Tversky (1979)) problems appear to violate literally the independence axiom, some experimental evidence implies that the inconsistency results, as well, from the complexity of choice pattern. For instance, Kahnemann and Tversky (1979) observed a dramatic decrease of violation frequencies when the common-ratio questions are presented in a two stage form, which clarify the way probability transformations are made. Moreover, Conlisk (1989) asserted that "the Allais pattern tend to disappear when the Allais questions are rephrased in the three-step form". Conlisk (1989) emphasized: "Violations are substantially less frequent, and they are no longer systematic". Subsequently; it is definitely assumed that violation, at least of one of the EUT axioms, is actual but the complexity of questions exaggerates it further. The frame of questions is a variant that is not provided by expected utility theoretical framework. Actually, rational decision theory assumes that various frames of mathematically equivalent contingencies, give rise to the same preferences. Nevertheless, experimental evidences illustrate how different presentations of the same decision problem result in peculiar patterns of behaviour.

One more observable phenomenon that obviously challenges the rational preference theory is the "preference reversals" phenomenon, which was first observed by cognitive psychologists, Slovic and Lichtenstein (1968). Grether and Plott (1979) scrutinized extensively the phenomenon and attempted to eliminate it by procedural variations and by salient incentives. Preference reversals phenomenon happens if subjects exhibit one choice ordering that is systemically different from his price ordering for one paired lottery with roughly equal expected value. This anomaly of decision is explained essentially in four ways. At first glance, this anomaly is directly assigned to violation of the transitivity axiom. Many authors, like Loomes and Sugden (1986) and Fishburn (1985), Grether and Plott (1979) argued for this possibility. Further, Holt (1986) and Karni and Safra (1987) assumed that preference reversals phenomenon is a direct violation of the independence axiom, and used generalized utility models which maintain transitivity. On the other hand, Segal (1988) underlined that the occurrence of preference reversals is only due to the failure of the reduction principle. Finally, Tversky et al. (1990) explained this puzzling phenomenon as a result of the weakness of procedure invariance.

These four explanations, as noted by Schlmildt and Hey (2004), command particular respect. In spite of this, there is no an ultimate explanation that elucidates permanently the causes of behavioural inconsistencies between alternatives methods of eliciting preferences. Curiously, alternative elicitation methods are not the only source of inconsistency, since only one frame may reveal preferences that contradict expected utility hypothesis. Cox and Epstein (1989) investigated the case of reversals in a lottery choice experiment, where subjects made only choices first from one set of paired lotteries and then from a second set with transformations of the original paired lotteries. Even though the experimental design does not involve any compound lottery and does not "require the independence axiom to interpret the results", Cox and Epstein (1989) observed a large frequency of reversals that Davis and Holt (1993) called "Choice reversals". This phenomenon results from the failure of the asymmetry axiom. Cox and

Epstein (1989) underlined that asymmetry axiom is more fundamental than the transitivity axiom, as it is possible to develop a choice model without transitivity.

Because asymmetry axiom is taken for granted, authors attempted to explain inconsistent behaviour over the weakness of axioms that are more open to criticism. As noted above, Holt (1986) argued for the violation of independence axiom to explain peculiar behaviour and pointed out that "preference reversal could also be generated by intransitivity, but abandon transitivity would be a drastic step that would make it difficult to construct a formal choice theory with empirical content. The transitivity assumption is needed for the existence of a utility functional that represents preferences over lotteries," (p514).
The current study presented in this paper aim at checking for the "Choice reversals" phenomenon in the context of Holt and Laury (2002) procedure. Holt and Laury (2002) (HL)'s procedure consists of a menu of paired lottery choices structured to elicit individual risk preferences assuming expected utility preferences.[4]

As soon as Holt and Laury (2002) exposed their elicitation procedure, some authors tested the robustness of the method in preserving EUT hypothesis and challenged its_quantitative results. According to these studies, Holt and Laury's procedure suffers from three anomalies: (1) Wealth effect: Heinemann (2003, 2005) ;(2) Order effect: Harrisson (2005); (3) Embedding effect: Bosch-Domènech and Silvestre (2006). Heinemann (2003, 2005) underlined that the methods of HL does not take into account the effect of wealth on the shape and the magnitude of relative risk aversion. He highlighted that, according to EUT theoretical framework, the hypothesis advanced by H-L concerning the shape of relative risk aversion does not hold when wealth is different from "0". He noted that the evidence is consistent with constant or even decreasing RRA instead of increasing RRA, for higher wealth levels. Besides, he argued that estimated degrees of RRA are

[4] Holt and Laury (2002) presented a lottery-choice experiment that consisted of a menu of paired lottery choices structured so that the crossover point to the high-risk lottery could be used to elicit individual risk preferences. Several treatments were implemented. In their baseline treatment, subjects were asked to choose between two lotteries, one "risky" (lottery payoff of \$3.85 or \$0.10) and one "safe" (lottery payoff of \$2 or \$1.60) with probabilities of winning the lottery (i.e. receiving the high payoff outcome) ranging from 10% to 100%. In a second treatment, subjects were asked to perform the same game as the baseline treatment except that payoffs were increased by 20. Finally, in a third treatment, subjects had to perform a hypothetical lottery choice experiment with lottery payoffs increased by a factor of 20 (20X). Holt and Laury observed that the magnitude of risk aversion increased from low to high real payoffs but did not find significant differences in risk preferences between low level payoffs and high hypothetical payoffs.

generally higher than given by Holt and Laury. However, he maintained the hypothesis that subjects "account only for a small (but non–negligible) fraction of their true wealth in laboratory decision situations", which explain the closeness of his results with those achieved by H-L under the omission of wealth.

Further, Harisson (2005) illustrates how the order of the questions alters the quantitative results of H-L. Actually, he replicated the experiment of H-L in a different order and noticed a smaller measure of relative risk aversion when the order effect is controlled. He noted that "The interval regression model predicts that the average CRRA coefficient for the 1x scale is 0.37, that it is 0.74 for the 10x scale when there are both order and scale effects present, and that it is 0.57 in the 10x scale when there are only scale effects". Subsequently, he emphasized that the scale effect in H-L's design is overestimated because it incorporates the order and the scale effect. Finally, Bosch-Domènech and Silvestre (2006) focused on the embedding bias in the case of H-L procedure. They analysed the decision on a given state $\overline{s}$ according to the sequence in which it is embedded. For that reason, they formulated four sequences, each one consist of 7 possible paired lotteries among H-L's pairwise questions. The sequences differ according to the position of the eliminated questions in the original design[5]. Their results argue for a change in behaviour according to the position of one question in the list. They noted that "participants tend to switch earlier to the riskier option when later pairs are eliminated from the sequence, suggesting the presence of some embedding bias." Consequently, subjects displays a decrease in risk aversion when the sequence ends earlier; when the largest probability is less then one. This bias does not show up for their experimental design (see authors for more details).

Though the three previous biases challenge H-L's qualitative results, Choice reversals challenges the qualitative since "no optimisation principals of any sort lie behind even the simplest of human choices", as noted by Grether and Plott (1979, p.623), when asymmetry axiom no longer holds.[6] Indeed, when measuring risk aversion assuming expected utility preferences, Holt and

[5] The five treatments are as follow : **T1**: the original design of H-L, **T2**: (p=0,1…0,7), **T3**: (p=0,3…0,9), T4: (p=0,4…1), T5:(p=0,2…0,8)

[6] Our experimental design is a perfect tool to investigate the choice reversals phenomenon. In fact, Davis and Holt (1993) called these reversals that way because questions are "…prompted by a lottery transformation rather than by a change in elicitation techniques". However, we investigate the case of reversals with the same paired lotteries when only one elicitation technique is used.

Laury (2002) presented an elicitation procedure that suffers, in our point of view, from a more critical issue which is the incoherence -non-asymmetry of preferences over lotteries. In fact, when paired lotteries are given to subjects under sequential framing, preferences are far from consistency.

We state that incoherence bias may not only be due to the lottery incentive mechanism itself but also to framing effect. Holt (1986) assumes that subject considers a random lottery experiment as a single choice problem entailing compound lottery. This statement approves the violation of the independence axiom, if inconsistency occurs, and maintains the more fundamental axiom of transitivity.

2.2. Framing effects and inconsistencies

There is an extensive literature covering the effect of the frame on the behaviour: (1) the frame of questions with gain and with losses (Tversky and Kahnemann, 1979, 1981); (2) eliciting preferences and inducing preferences: preference reversals; (3) WTA/WTP… However, up to now, little attention has been devoted to the question, to what extent small changes of the presentation of questions affect the perception of contingencies? Our study aims at identifying the causes of choice reversals in the case of sequential questions in respect to simultaneous questions using HL's procedure.

In a related paper, Hey and Lee (2005) examined the robustness of random lottery incentive mechanism by testing the separation hypothesis advanced by Starmer and Sugden (1991). The separation hypothesis is a requirement of rational behaviour, since subject who respects EUT should consider questions separately and not as a whole. Even thought the purpose of the previous papers differ from the current study, the "separation hypothesis" supports, in some way, the evidence that the frame of questions should not affect the consistency of behaviour. Hey and Lee (2005) and Starmer and Sugden (1991) showed that subjects consider the questions separately and do not choose the best strategy to win in the experiment. This evidence favours the EUT because subjects who consider the experiment as a whole will deviate from the conditions of coherence. In fact, Hey and Lee (2005) assert that if the subjects consider the experiment as a whole, their best response to an individual question may not be the same response as would be given if the experiment consisted of just that one question. (See also Karni and Safra (1987), and

Holt (1986)). They add “If the subject’s preferences are in accordance with Expected Utility theory, then the subject’s best strategy is simply to answer each question separately”.

In principle, Hey and Lee (2005) take two choice procedure problems, the pairwise choice part and the complete ranking part. In the first part, subject were given 30 parwise choice questions and was asked to indicate their preferred gamble. In the second part, subjects were asked to rank 11 gambles starting by the most preferred. It should be noted that the 30 pairwise choice questions consisted of some possible[7] pairwise choices among the 11 gambles of the complete ranking part. Their results argue for the separation hypothesis, and subjects are not sophisticated as they consider each question on its own.

Further, Starmer and Sugden (1991) provide some indirect support to our study. They construct their experimental design to test essentially the reduction principle in the case of the random-lottery experiment. Two pairwise choices P’ and P” were give to their four groups. Groups are asked both paiwise choice questions in different order and with a different payoff mechanism. Group A is paid off for real on question P”; group D is paid off on question P’ and the remaining groups are paid off randomly on P’ or on P”. According to Starmer and Sugden (1991), it may be some contamination effect between random lottery experiments and real-choice experiments because responses in the former procedure may be contaminated by the influence of other problems. However, experimental evidences, combined with their results (1998) showed no such bias. Accordingly, the random lottery procedure seems to reveal ‘real’ preferences over risky prospects. Tough, all these evidences pertain to the failure of the independence axiom in the case of the random-lottery experiments and in the case of real choices, and do not allow us to test the stability of choices made in the case of random-lottery incentives mechanism but accomplished differently.

[7] The set of the pariwise lottery consists of all possible pairwise choices in which no one gamble dominated the other

2.3. Monetary incentives and stability of choices

In a recent paper, Laury (2005) tested the robustness of the random lottery incentive mechanism in general, and in particular the H-L's procedure. In order to examine the possible "under-perception" of risk in the elicitation method under consideration, she mentioned that her experimental design "focuses only on the payoff-scale effect of the random selection procedure. She tested whether subjects scale down payoffs when random lottery incentive procedure is used to elucidate the fact that they are paid off on only one decision at the end of the experiment. She compared the responses of tree different treatments; "*1x Pay One*" is the original experiment in Holt and Laury (2002); "*10 x Pay One*" is the same experiment where payoffs are scaled up 10, "*1x Pay All*" in which the payoffs were the same as in "*1xPay One*" but in which the random lottery incentive mechanism is abandoned, i.e. subjects are paid on each question of the experiment. The results showed that people do not consider the random lottery procedure as a decrease in incentives as she observed identical decisions in the "1x Pay One" and "1x Pay All" treatments. However, she noted significant increase of risk aversion when payoffs are scaled up by 10. Given this experimental evidence, Laury (2005) authenticates the superiority of the procedure she performed with Holt (2002). Nevertheless, she did notice that about 15 percent of the subjects switched more than once to the risky option, though this does not alter much her results. Holt and Laury (2002) noted that about 13% of subjects switched back in the first low-payoff questions and only 6% in only switched back in the final low-payoff questions and that these choices are irrelevant to the results.

Monetary incentives may have a fundamental effect on the stability of choice, and on the validity of revealed preferences. This feature has long been the focus of many researchers who disapproved the use of very small rewards. For instance, Rabin (1999, 2000) argues that the failure of EUT to explain risk attitude might be explained by the use of modest stakes and disapproves the claim that the scale of incentives have no role in the explanation of behaviour since experimental evidence suggests the opposite and revealed clearly that financial incentives matter. Furthermore Pommerehne et al. (1982) showed how increasing incentives resulted in a significant reduction in the frequency of preference reversals. Reilly (1982) adopted the same approach to test the possible insufficient incentives on the persistency of preference reversals. To do, he increased the payoff in stake and observed a decreased of preference reversals. Besides, Starmer and Sugden (1991) considered incentives as some determinant of preference reversals. They reported that monetary incentives affect the quantitative (although not the qualitative) nature of lottery-choice inconsistencies. In this perspective, our experimental will seek to examine to what extent financial incentives may also increase the saliency of decisions by affecting performance.

3- Experimental design

3.1 Overview

There are twelve different treatments in the experiment, all of which are based on the procedure of Holt and Laury (2002), consisting of a menu of paired lottery choices structured to elicit individual risk preferences. Specifically, we examine treatments where participants are either confronted with simultaneous or sequential decisions and/or confronted with probabilities ranged in an increasing, decreasing or random manner. We also ran some treatments in which payoffs were increased by 10.

Our Baseline treatment, called SIMINC treatment, is a replication of HL's "low real payoff" treatment. In this treatment the participants are confronted with ten simultaneous choices between two lotteries, one "risky" (lottery payoff of $3.85 or $0.10) and one "safe" (lottery payoff of $2 or $1.60) with probabilities ranging from 10% to 100% (see table 1). In both options, the probabilities for the first decision are 1/10 and 9/10 but the payoffs differ such that in this decision, only an extreme risk seeker would choose Option B. When the probability of the high payoff outcome increases sufficiently a subject may cross over to Option B.

The SIMDEC and SIMRAND treatments are identical to the SIMINC treatment presented above except that the probabilities were ranged in the table in a decreasing order and in a random order, respectively. In a fourth treatment called SEQINC, participants played exactly the same treatment as the baseline treatment except that the ten decisions were not presented simultaneously but given sequentially with probabilities ranged in a similar increasing manner from 10% to 100%. The SEQDEC and SEQRAND treatments were also designed in a sequential way but with probabilities ranged, respectively, in a decreasing or in a random manner.

Finally, all these treatments were also played under a high payoff condition in which the payoffs were replaced with 10x payoffs.

Table 1. Standard Payoff Matrix for the SIMINC treatment

	Safe Lottery (S)				Risky Lottery (R)				
	Prob.	Payoff	Prob.	Payo ff	Prob.	Payoff	Prob.	Payoff	Difference
1	10%	2	90%	1,6	10%	3,85	90%	0,10	1,17
2	20%	2	80%	1,6	20%	3,85	80%	0,10	0,83
3	30%	2	70%	1,6	30%	3,85	70%	0,10	0,50
4	40%	2	60%	1,6	40%	3,85	60%	0,10	0,16
5	50%	2	50%	1,6	50%	3,85	50%	0,10	-0,18
6	60%	2	40%	1,6	60°%	3,85	40%	0,10	-0,51
7	70%	2	30%	1,6	70%	3,85	30%	0,10	-0,85
8	80%	2	20%	1,6	80%	3,85	20%	0,10	-1,18
9	90%	2	10%	1,6	90%	3,85	10%	0,10	-1,52
10	100%	2	0%	1,6	100%	3,85	0%	0,10	-1,85

Note: Expected payoffs were not provided in the instructions to the participants.

Our overall design consists of ten sessions (with 12 subjects each) of a lottery choice experiment. In each session, subjects were confronted with 3 to 4 successive treatments. Experimental sessions were conducted both at the University of Rennes and at the University of Paris in France. To control for a potential order effect, we varied the order of the treatment across sessions to isolate a potential experience effect. Indeed, as is clear from the above discussion, the previous results on the effect of prior experience on decision on subsequent choices are mixed. The results of Harrison et al. (2005) suggest that making decisions in the low payoff treatment has an effect on subsequent choices in the high payoff treatment (order effect increases subject's risk aversion); while the results of Holt and Laury (2005) suggest that the order effect is not clear-cut. Table 2 contains some summary information about each of the sessions of our 2 × 3 ×2 experimental design. The first four columns indicate the session number, the number of subjects that took part in the session and the location. The three (or four) last columns of Table 2 indicate the treatment in effect in each segment of the session.

Table 2: Characteristics of the Experimental Sessions

Session Number	Number of Subjects	Location	Treatments			
			Order 1	Order 2	Order 3	Order 4
1	12	Rennes	SIMINC	SIMRAND	SIMDEC	SIMINCx10
2	12	Rennes	SIMRAND	SIMINC	SIMDEC	SIMDECx10
3	12	Rennes	SIMDEC	SIMINC	SIMRAND	SIMRANDx10
4	12	Rennes	SEQINC	SEQRAND	SEQDEC	SEQINCx10
5	12	Paris	SEQRAND	SEQINC	SEQDEC	SEQDECx10
6	12	Paris	SEQDEC	SEQINC	SEQRAND	SEQRANDx10
7	12	Paris	SEQRAND	SIMRAND	SEQDEC	SEQDECx10
8	12	Paris	SIMRAND	SEQRAND	SIMDEC	SIMDECx10
9	12	Paris	SEQINCx10	SEQRANDx10	SEQDECx10	
10	12	Rennes	SEQRANDx10	SEQINCx10	SEQDECx10	

Lecture : in session 4, 12 participants played successively SEQINC, SEQRAND, SEQDEC and SEQINCx10 treatments.

3.2 Procedures

The experiment was computerized and the scripts were programmed using the z-tree platform (Fischbacher, 1999). We recruited 120 subjects from undergraduate courses in business and economics at the University. No subject participated in more than one session. In sessions 9-10, subjects were informed that three set of lottery choices would be successively implemented. However, to control for wealth effects, subjects were informed that only one of the three treatment payoffs will be chosen for the payment at the end of the experiment. Similar rules were implemented in session 1-8. In particular, subjects were not informed at the beginning of the experiment that an additional fourth treatment will be played. At the end of the third treatment, subjects were informed of their final payment for the experience chosen among the three treatment payoffs. Then subjects were asked to give up what they had earned in the previous treatments in order to participate in the high payoff treatment. Only one participant declined to participate. Notice that we controlled in our analysis both for a possible selection bias due to participation and for possible payment rule effects since not exactly similar payment rules were implemented in session 1-8 and session 9-10. None of these differences seemed to have significantly affected decisions.[8] On average, a session lasted for about an hour and 20 minutes, including the initial instructions and payment of subjects. Each participant earned $40 on average.

4- Results

4.1. Degree of inconsistency

In the context of Holt and Laury lottery-choice experiment, we define consistency as the fact that an individual never switches back from one option to one other. In general, we can observe two categories of consistent behaviour: (1) Subjects who have only one switch point (from S to R), (2) Subjects who ever choose the risky option. Accordingly, we define inconsistency as all observed behaviours that differ from the formers. In instance, people who first choose the safe (risky) option and then switch to the risky (safe) option before switching back to the safe option (risky) are inconsistent. Besides, we assume that subjects who ever choose the safe option or choose first the risky option and then switch once to the safe option are inconsistent. This behaviour is absurd since subjects prefer less money (2$ instead of 3.85$) for p=1. For simplicity, we consider inconsistent behaviour as the repetitive switch from one option (safe or risky) to the other.

Consistent with previous results obtained by Holt and Laury (2002), we found that almost all the subjects chose the safe option for small probability of the high payoff, and then switch to the riskier option when the probability of the high payoff increases sufficiently. However, we also found that a non negligible part of players exhibited incoherent behaviour.. For example several participants switched from lottery R to lottery S more than once. These observations are summarised and supported in result 1.

Result 1a*: A non negligible number of subjects exhibited incoherent decisions in all treatments. However, incoherence is less pronounced for high payoffs than for low payoffs. Monetary incentives seem to matters in choice situations and enhance performance.*

[8] Detailed results concerning these effects are available on request.

Support for Result 1a. Table 3 provides a preliminary analysis of the degree of inconsistencies in each treatment. It shows the number of subjects who exhibited incoherent behaviour, including those who switched from S to R more than once.

Table 3: Number of subjects exhibiting incoherent behaviour

Type of Questions	Probabilities range	Proportion of Inconsistent	Proportion of Inconsistent choices (%)	Subjects who displayed inconsistency at least twice
		Low incentives		
	Increasing *p*	9 (N=36)	25	8(N=36)
Simultaneous	Decreasing *p*	4 (N=48)	8.33	2 (N=48)
Choices	Random *p*	13 (N=60)	21.67	11 (N=60)
	All treatments	17(N=60)	18.06	15 (N=60)
	Increasing *p*	12 (N=36)	33.33	12 (N=36)
Sequential	Decreasing *p*	7 (N=36)	14.58	7 (N=36)
Choices	Random *p*	14 (N=60)	23.33	14 (N=60)
	All treatments	24 (N=60)	22.92	24 (N=60)
Aggregate data	*N=**96***	**37**	**20.49**	**36**
		High incentives		
	Increasing *p*	0 (N=12)	0	0 (N=12)
Simultaneous	Decreasing *p*	1 (N=24)	4.17	1 (N=24)
Choices	Random *p*	1 (N=12)	8.33	1 (N=12)
	All treatments	2 (N= 48)	4.17	2 (N=48)
	Increasing *p*	7 (N=36)	19.44	7
Sequential	Decreasing *p*	8 (N=48)	16.67	6
Choices	Random *p*	4 (N=36)	11.11	4
	All treatments	16 (N=72)	15.83	14 (N=72)
Aggregate data	*N= **120***	**18**	**12.50**	**16**

Table 3 shows that in all session, 47 of 120 subjects (39.16 percent of participants) made inconsistent decisions[9]. About 17.53 percent of choices were inconsistent, in the sense that subjects chose first the safe (risky) option and then crossed over to the risky (safe) option before going back to the safe (risky) option[10]. Moreover, comparing data with and without incoherence,

[9] If we consider subjects who ever chose the safe option or chose first the risky option and then crossed over to the safe option one time as inconsistent, the analyses changes very little. The number of subjects exhibiting inconsistent behaviour in this case is 51 over 120. The frequency of inconsistent decision increases somewhat and get 18.86 percent. Similarly, if we restrict our analyses to subjects who never chose the safe option for sure, we observe 38 of 108 subjects who were inconsistent and who exhibited 14.63 percent of irregular choices (60 of 410 choices were irregular). The student test fails to reject the null hypothesis that the analysis differs with this restriction.

[10] We note that 11 subjects choose the risky option for the first lottery pair of HL. Two subjects switched only once to the safe option, and nine subjects had repetitive switch points (2 subjects chose the safe option for sure). We observe the latter behaviour four times in sequential treatments with decreasing probability (T4,T5,T8), 3 times in

we find that inconsistency is significant at any level of standard significance[11] and can not be neglected.

Further, Table 3 indicates that repetitive switches are more frequent for low incentives, where 37 of 96 subjects (about 38.6%) exhibited irregular behaviour. For low payoff, 59 of 228 (20.5%) decisions are incoherent, as subjects switched from the risky (safe) to the safe (risky) option more than once.[12] This tendency is about two times lower for valuable incentives, where only 18 of 120 subjects switched from one option to another more than once (about 21 of 141 choices are irregular). Contrarily to Holt and Laury who noted that this difference is small, we find that this difference is significant at 5% level of confidence using both the Student test (p (T>t) = 0.015) and the Mann-Whitney test (p (T>t) = 0.03) of the null hypothesis that the frequency of incoherence for low payoff is equal to the frequency of incoherence for high payoff. This finding validates the hypothesis that monetary incentives matters in choice situation in general and lottery choice situations especially, by enhancing performance. It appears that monetary incentives have a fundamental effect on the stability of choice, and on the validity of revealed preferences (see Holt (1993), Harrison (1998), Cox and Epstein (1989)).[13]

Figure 1 displays the frequency of incoherence for low payoff, for High payoff and for the full Data. We obviously observe a larger frequency of incoherence when incentives are not valuable which can be explained by the lack of motivation that ensues to a less attention to the question. Consequently, errors of judgment are more pronounced and inconsistent behaviours are obvious. This finding challenges quantitative, and to some extend qualitative results based only on experiments with negligible or hypothetical gains.

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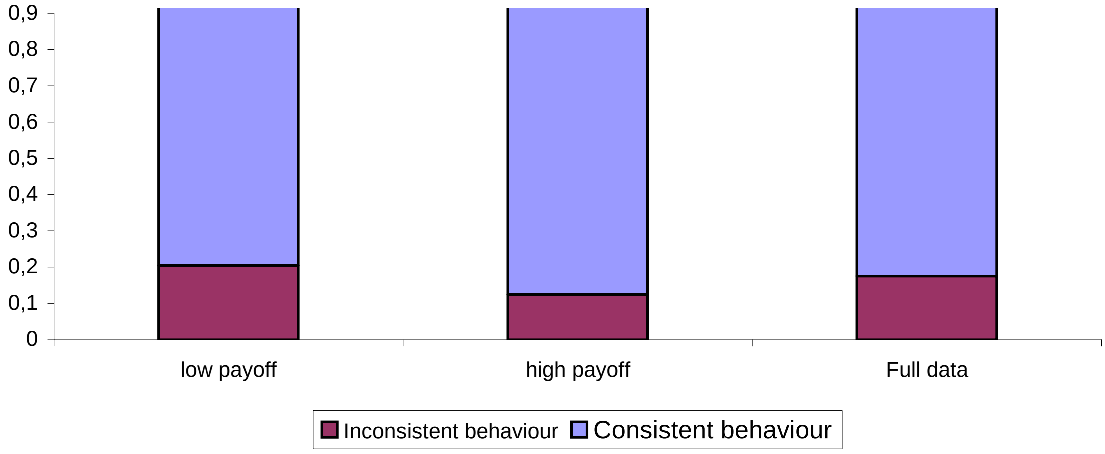
simultaneous treatments with decreasing probability (T2,T11), two times in simultaneous treatment(T3) with random probability and one time in simultaneous increasing treatment (T1). This behaviour is exhibited by 8 subjects for low payoffs (for all treatments) and only by one subject for high payoff.

[11] We test the null hypothesis that subjects switch only once from the safe option to the risky option. The hypothesis is also rejected at all standard level of confidence using both the student test and the wilcoxon test.

[12] If we restrict the analysis to subjects who never exhibited "absurd" behaviour (ever choosing S or choosing S for p=1), we observe that 17.44 percent of choices were inconsistent in the low payoff treatments, where subjects switched back from R to S. About 17.05 percent of these choices had more than 2 switch points. As we develop above, the analysis doesn't change much when we don't restrict the data.

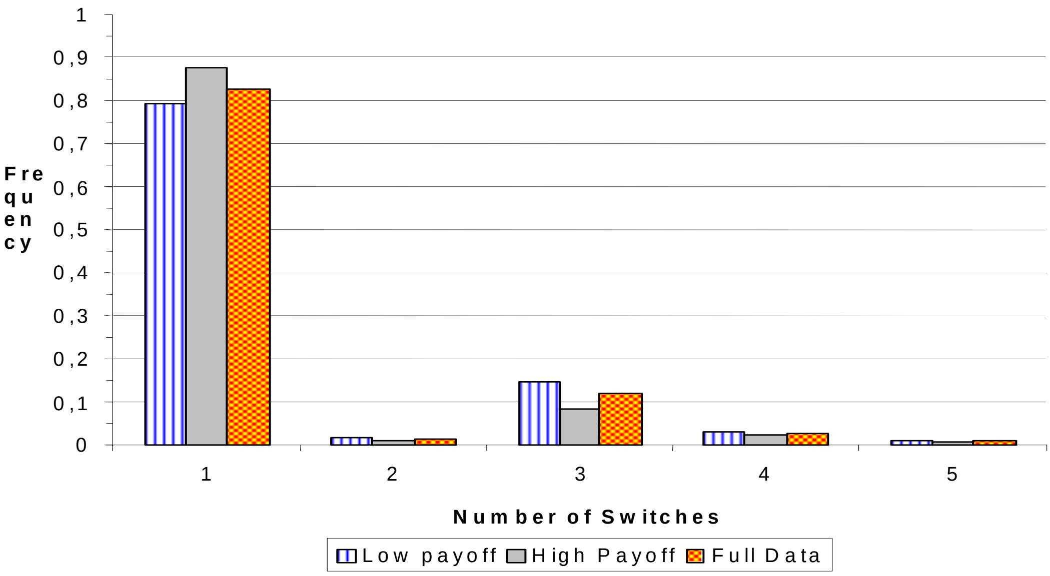
[13] Harisson (1998) asserted that the losses due to irrational behaviour are often a matter of pennies.

Figure 1. Frequency of Inconsistent Behaviour for Low Payoff, for High Payoff (10×), and in the Full Data.



Given the number of switches from the safe option to the risky option, we observe that the majority of subjects exhibiting inconsistent behaviour switch twice from the safe to the risky option. Figure **2.a** displays the proportion of errors for Low payoff and for High payoff. It shows that most of inconsistencies consist of at least 3 switches. Moreover, Figure **2.a** also indicates that the level of inconsistencies is smaller for high payoff, which confirms our previous results and validates the effect of incentives on the stability of preferences and on the adherence to EUT requirements (See figure 2.b and 2.c for more details).

Figure 2.a. Number of Switches from the Safe Option to the Risky Option.



We focus now on the effects of framing on the inconsistency of choices. Our observations are stated precisely in result 1b.

Result 1b. *Framing matters in the level of inconsistencies. Consistent with assumption tht full information about the whole game matters in choice situation and improve coherence, we find that simultaneous presentation reduces significantly the magnitude of incoherence.. In contrast presenting probabilities in a random or decreasing manner compared to an increasing manner does not significantly influence inconsistencies.*

Support for Result 1b. Table 3 indicates that for both low and high payoff conditions, the level of inconsistencies increases under a sequential framing.In all sessions, 30 percents of subjects were inconsistent in the simultaneous frame (14.58 percent of inconsistent choices) and about 39.5 percent in the sequential frame(19.70 percent of inconsistent choices). When we restrict the analysis to low payoff responses, where violations are more frequent, we observe that inconsistent responses in sequential treatment are higher than for simultaneous responses.
However, choice-questions are generally framed is a sequential manner which favours the violation of the stochastic dominance and weaken more the EUT requirements.

To provide a more formal evidence for result 1a and 1b, Table 4 presents a probit model, using "safe choice" (lottery S) as the dependent variable. The right-hand side variables include the probability of winning the larger amount (0.1 to 1.0), and several dummy variables for the order of decision (simultaneous or sequential presentation of the same paired lotteries), the way the probabilities are ranged (in an increasing, decreasing or random manner) and the level of payoff (High or low payoff). We also introduced variables that control for a possible order effect. The variables order2 order3 and order4 are interpreted in relation with the omitted variable that corresponds to the treatment played first in the session (order1). Finally, the estimations include standard demographics variables such as gender and age.

Table 4. The determinants of Inconsistency (Probit estimations)

Variable	All data (1)	All data (2)	All data (3)	All data (4)	Seq treat. (5)	Sim treat (6)	Low payoff (7)	High payoff (8)	Low payoff (9)	High payoff (10)
Probability		0,109***								
		(0,014)								
High payoff	-0,282***	-0,298***	-0,232**	-0,327***	-0,260**	-0,692***				
	(0,104)	(0,107)	(0,106)	(0,109)	(0,106)	(0,214)				
Random framing	-0,074	-0,087	-0,090	-0,090	-0,222**	0,158	-0,062	-0,216	-0,099	-0,230
	(0,083)	(0,086)	(0,085)	(0,086)	(0,107)	(0,140)	(0,098)	(0,173)	(0,100)	(0,176)
Decreasing framing	-0,010	-0,016	-0,023	-0,017	-0,072	0,072	-0,190	0,247	-0,201	0,291
	(0,110)	(0,114)	(0,112)	(0,114)	(0,134)	(0,208)	(0,141)	(0,197)	(0,147)	(0,199)
Sequential Treat.	0,287***	0,301***	0,291***	0,320***			0,209**	0,699***	0,233***	0,655***
	(0,075)	(0,078)	(0,077)	(0,079)			(0,083)	(0,208)	(0,086)	(0,213)
Order2	-0,195**	-0,200**	-0,196**	-0,197**	-0,461***	0,166	-0,266***	-0,068	-0,259***	-0,083
	(0,087)	(0,090)	(0,088)	(0,089)	(0,116)	(0,142)	(0,097)	(0,210)	(0,099)	(0,215)
Order 3	-0,560***	-0,567***	-0,564***	-0,568***	-0,499***	-0,805***	-0,528***	-0,580**	-0,541***	-0,640**
	(0,115)	(0,119)	(0,118)	(0,119)	(0,138)	(0,245)	(0,127)	(0,290)	(0,134)	(0,295)
Order 4	-0,215	-0,226	-0,251*	-0,167	-0,161			-0,163		-0,215
	(0,138)	(0,143)	(0,140)	(0,142)	(0,151)			(0,210)		(0,214)
Age			0,024**	0,016					0,032**	-0,037
			(0,012)	(0,012)					(0,013)	(0,035)
Male			0,152**	0,193***					0,308***	-0,216*
			(0,070)	(0,073)					(0,088)	(0,130)
Degree			-0,267***	-0,242***					-0,359***	-0,057
			(0,059)	(0,059)					(0,078)	(0,096)
Management				-0,378***						
				(0,143)						
Law				0,192**						
				(0,092)						
Administration				-0,064						
				(0,158)						
Economics				-0,125						
				(0,099)						
Constant	-1,577***	-2,253***	-1,810***	-1,680***	-1,181***	-1,785***	-1,474***	-2,326***	-1,855***	-1,318***
	(0,093)	(0,132)	(0,240)	(0,246)	(0,100)	(0,146)	(0,105)	(0,267)	(0,272)	(0,690)
Number of observations	4560	4560	4560	4560	2640	1920	2880	1680	2880	1680
Log Likelihood	-760.68	-724.77	-745.96	-737.08	-503.58	-242.2	-535.88	-217.77	-516.97	-214.06

*** 1% significance level, ** 5% significance level, * 10% significance level, Standard error in parenthesis

Table 4 indicates that the probability of being inconsistent for a particular decision significantly increases with the probability but significantly decreases with the level of payoff, which is consistent with our previous results. It confirms the fact that when payoffs in stake are important, individuals pay more attention to each decision and make less error. Also consistent with our previous preliminary results is that *sequentiality* tends to induce higher level of inconsistencies. In fact, in the low treatment condition, the sequential frame increases the probability of observing inconsistent choices by 0.233 (p <0.05). If we restrict, now, our analysis to high payoff responses, we observe that inconsistent behaviour is, also, less frequent for the simultaneous frame than for the sequential frame. In fact, the sequential frame increases the probability of being inconsistent by 0.655 (p<0.01). The distortion between simultaneous and sequential frame is mostly a matter of the lack of information. Simultaneous treatments guarantee the reduction of bias for high payoff according to sequential treatment which is a problem to experimentalists. These results corroborate our assumption that subjects make less errors in the original frame elaborated by H-L, especially if they are motivated enough to consider the questions attentively. The other interesting information provided by table 4 is that the coefficients associated with some demographic variables are significant. For example, it appears that the level of inconsistencies decreases with the level of education. Finally Table 4 reveals that the level of inconsistent behaviour significantly decreases over time. This is stated more precisely in result 2.

Result 2*: the probability of revealing consistent preferences increasing over time especially when information is not fully available (for sequential treatment) and when amounts in stakes are not valuable.*

Support for result 2. The coefficients associated with order dummy variables indicate that order effect is statistically significant, with p-values less than 0.05 for order2 and less than 0.01 for order 3. It seems that the order effect involves a "learning" process that reduces the tendency of violating rationality requirement. The order effect is more manifest for low payoff than for high payoff. This is obviously due to the performance involved by incentives. We noted above that subjects are more careful and more risk averse for high payoff. Consequently the learning component is substituted by the saliency of decisions. In addition, we observed that the order effect is systematic for sequential treatments, where the second game decreases the probability of inconsistency by 0.461 and the third game by 0.499. Simultaneous treatments are less affected by order. The availability of information about the characteristics of the gamble makes order less crucial for the adherence to coherence requirements.

4.2. Determinants of choosing the safe option

In this section, we investigate to what extent framing also affects the attitude of subjects toward risk. As mentioned above, we conjecture that the probability of choosing the safe option may be affected by framing in two different ways. First, framing may have a direct impact on this probability, by inducing for example a lower level of information about all relevant alternatives in the game. Second, framing may also indirectly influence the proportion of safe choices because of a higher level of inconsistencies induced. In this section, we will seek to investigate the effects of framing on the probability of choosing the safe lottery, disentangling the direct and indirect effects. Following H-L, the number of safe choices will specify the attitude of subjects toward risk. Accordingly, we display the proportion of safe choices for low payoff and for high payoff and we compare them to the proportion of safe choices. The effect of framing on risk attitude is summarized in Result 2.

Result 3. *The probability of choosing the safe option increases under a sequential framing. Similarly, the probability of choosing the safe option is lower under an increasing framing than under a random framing.*

Support for result 3. Figure 1 shows the proportion of S choices (safe option) in each decision of the sequential and simultaneous treatments for both low and high payoffs conditions. The horizontal axis represents the decision number, which corresponds to the probability of the higher payoff.

Figure 3 indicates that the percentage choosing the safe option S falls as the probability of the higher payoff increases. Further, individuals tend to report higher levels of risk aversion under the high payoff conditions. This is consistent with the result of Holt and Laury (2002). Finally, Figure 3 shows that the proportion of S choices tends to increase under a sequential framing, both in the low and high payoff conditions. Consistent with this result, a Mann-Whitney test on the total number of "safe" lottery choices over the first ten periods rejects the null hypothesis of equal means between the simultaneous and sequential treatments under the low payoff condition ($p<0.05$). A similar test over periods for high payoff condition produces similar results ($p<0.05$).

One might argue that the results of framing may be due in fact to a higher level of inconsistencies under sequential framing as shown previously. To test for this hypothesis, we replicated previous results for consistent choices only. These results are given in figures 4a and 4b.

Figure 3. Proportion of Safe Choices in each Decision.

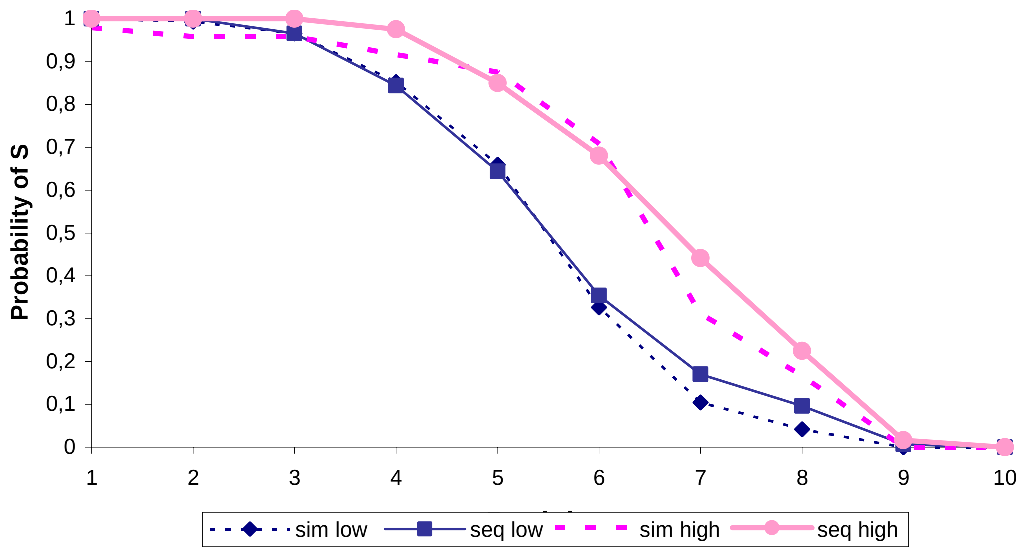


Figure 4a. The Proportion of Safe Choices in Each Decision:
Simultaneous vs Sequential (without incoherent choices) for low payoff

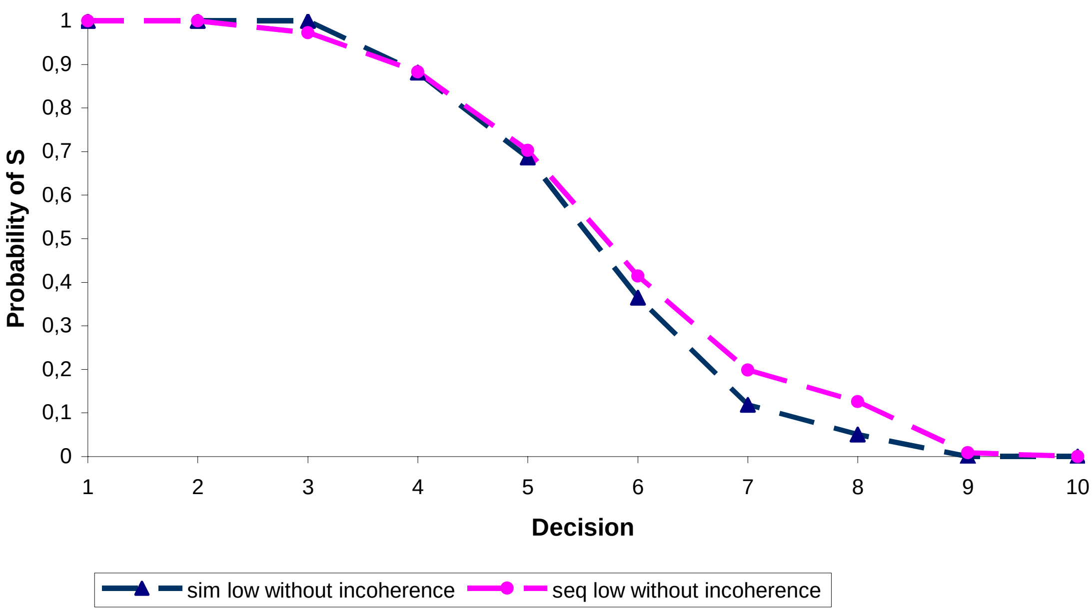
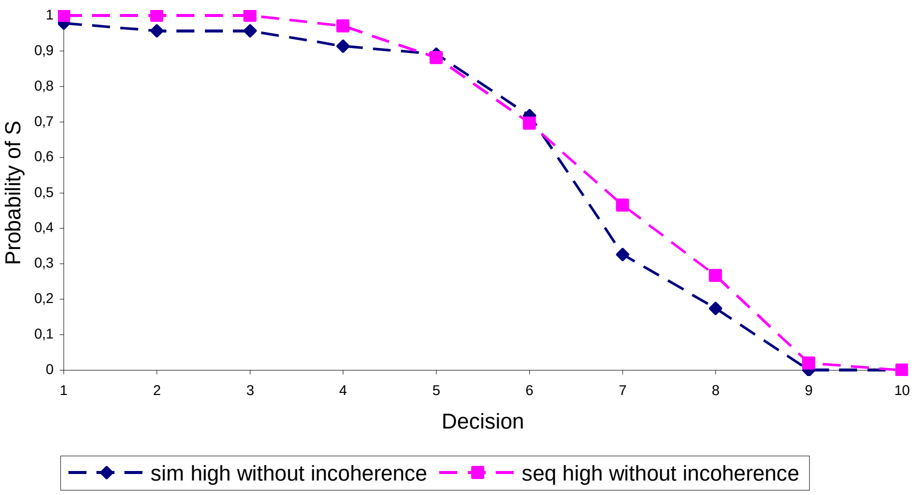


Figure 4b. The Proportion of Safe Choices in Each Decision:
Simultaneous vs Sequential (without incoherent choices) for high payoff



Figures 4a and 4b show similar pattern as those obtained in figure 3, indicating that even in absence of inconsistencies, sequential framing leads to increase the probability of choosing the safe option. This result is consistent with the existence of a direct effect of sequentiality on risk decision. Figure 5a and 5b display the corresponding data for increasing, decreasing and random framing under low and high payoff conditions, respectively. The horizontal axis represents the decision number, which corresponds to the probability of the higher payoff.

Figure 5a. The Proportion of Safe Choices in Each Decision:
Random, Increasing and Decreasing framing for low payoff

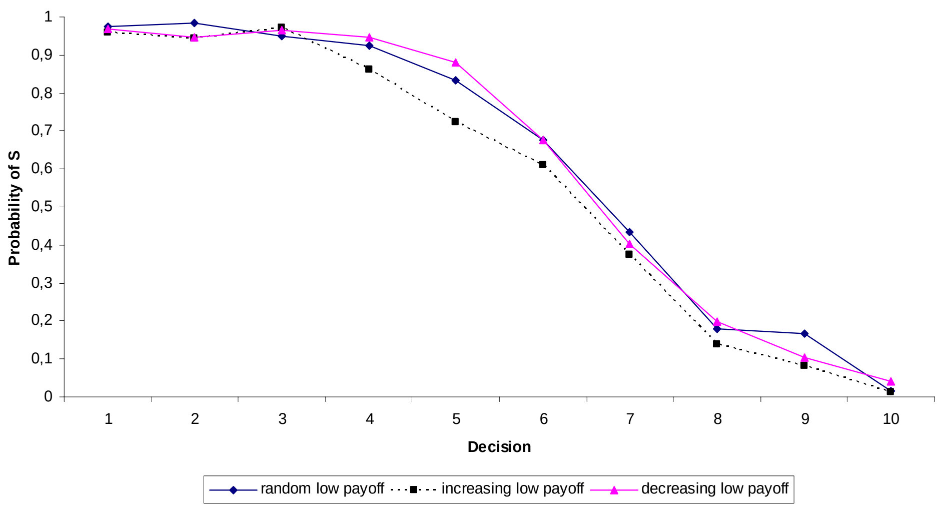
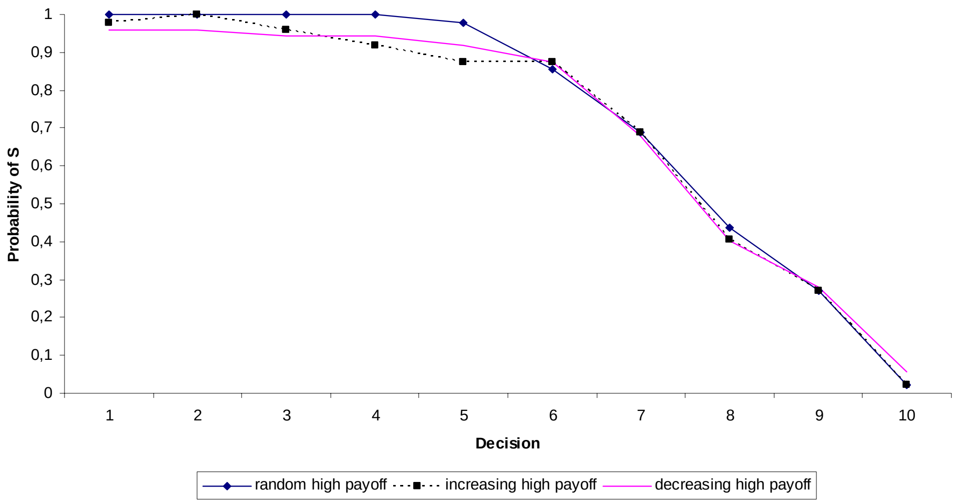


Figure 5b. The Proportion of Safe Choices in Each Decision: Random, Increasing and Decreasing framing for high payoff



Figures 5a and 5b show that the probability of choosing the safe option tends to be higher when the probabilities are ranged in a decreasing or random manner instead of an increasing way.

A Mann-Whitney test on the total number of "safe" lottery choices rejects the null hypothesis of equal means between the increasing and decreasing treatments under the low payoff condition ($p<0.05$). A similar test between the increasing and random treatment also indicates significant differences ($p<0.05$). However a Mann-Whitney test on the total number of "safe" lottery choices cannot reject the null hypothesis of equal means between the decreasing and radom treatments under the low payoff condition ($p>0.10$). Turning next to high payoff condition, we find that differences between treatments are not significant.

Table 5 provides a formal proof for the effects of framing on the decisions toward risk. Table 5 presents a probit model of the probability of choosing the safe lottery. The independent variables include the probability of winning the larger amount, dummies for high payoff condition and several other dummies for framing: sequential, decreasing and random framing. We also introduced variables that control for a possible order effect and several standard demographics variables such as gender and age.

Table5: Probability of choosing the safe option (Probit estimations)

Variable	All data (1)	All data (2)	All data (3)	All data (9)	Sequential treatment (4)	Simu. treatment (5)	All data (6)	All data (6bis)	All data (6bis2)	Sequential treatment (7)	Sim treatment (8)
Probability	-0,475***	-0,475***	-0,475***	-0,477***	-0,471***	-0,483***	-0,478***	-0,478***	-0,480***	-0,479***	-0,483***
	(0,012)	(0,012)	(0,012)	(0,012)	(0,016)	(0,018)	(0,012)	(0,012)	(0,012)	(0,016)	(0,018)
High payoff	0,611***	0,514***	0,497***	0,499***	0,566***	0,352**	0,498***	0,508***	0,499***	0,561***	0,355**
	(0,073)	(0,065)	(0,064)	(0,064)	(0,074)	(0,145)	(0,064)	(0,065)	(0,065)	(0,076)	(0,145)
Random framing	0,192***	0,181***	0,130**	0,131**	0,147*	0,234**	0,136**	0,133**	0,137**	0,174**	0,238**
	(0,065)	(0,065)	(0,054)	(0,054)	(0,085)	(0,101)	(0,054)	(0,054)	(0,054)	(0,086)	(0,101)
Decreasing framing	0,113	0,099			0,222**	-0,052				0,242**	-0,040
	(0,081)	(0,071)			(0,096)	(0,106)				(0,097)	(0,107)
Sequential Treat.		0,147*	0,170**	0,164**			0,150*	0,145*	0,144*		
		(0,078)	(0,076)	(0,077)			(0,077)	(0,077)	(0,077)		
Inconsistency				0,182*					0,194*		
				(0,104)					(0,104)		
Order 2	0,061										
	(0,070)										
Order 3	0,070										
	(0,080)										
Order4	-0,085										
	(0,096)										
Order		0,004	0,019	0,023	-0,014	0,060	0,021	0,018	0,026	-0,011	0,059
		(0,030)	(0,028)	(0,028)	(0,038)	(0,059)	(0,028)	(0,028)	(0,028)	(0,038)	(0,059)
Period		-0,015	-0,020	-0,019	-0,008		-0,020	-0,020	-0,020	-0,008	
		(0,013)	(0,013)	(0,013)	(0,013)		(0,013)	(0,013)	(0,013)	(0,014)	
Men							-0,216***	-0,216***	-0,220***	-0,390***	-0,010
							(0,051)	(0,052)	(0,051)	(0,069)	(0,081)
Degree							-0,019	-0,027	-0,014	0,028	-0,034
							(0,031)	(0,032)	(0,031)	(0,054)	(0,048)
Age							-0,002	-0,002	-0,003	-0,013	-0,002
							(0,008)	(0,008)	(0,008)	(0,018)	(0,010)
Economics							0,064	0,027	0,063	-0,026	0,103
							(0,053)	(0,069)	(0,053)	(0,072)	(0,082)
Management								-0,015			
								(0,093)			
Law								-0,074			
								(0,080)			
Administration								-0,093			
								(0,128)			
Constant	2,918***	2,943***	2,968***	2,961***	3,014***	2,914***	3,162***	3,199***	3,157***	3,466***	2,974***
	(0,097)	(0,110)	(0,109)	(0,109)	(0,160)	(0,170)	(0,199)	(0,207)	(0,199)	(0,361)	(0,275)
Number of observations	4560	4560	4560	4560	2640	1920	4560	4560	4560	2640	1920
Log Likelihood	-1605.1	-1605.04	-1606	-1604.46	-928.27	-671.8	-1594.9	-1594.32	-1593.17	-911.25	-670.2

*** 1% significance level, ** 5% significance level, * 10% significance level, Standard error in parenthesis

Table 5 clearly indicates the importance of framing in the probability of choosing the safe option. The specifications of Table 5 reveal that the probability that the safe option A is chosen increases when the framing is sequential and/or when the probabilities are ranged in a random manner. Irrespective of these variables Table 5 also indicates that the probability that the safe option A is chosen decreases when the probability of the higher payoff increases, which is consistent with previous results. Finally, consistent with HL (2002), our results also show that the probability of choosing the safe option A increases as real payoffs are scaled up, suggesting the importance of context.

5. Conclusion

Several empirical tests for expected utility theory (EUT) have been conducted since the original discussion of independence axiom by Allais (1954). All of these tests tend to be quite negative for EUT since a very poor number of decisions are consistent with it (See Camerer 1995, Starmer 2000 for surveys).

A major criticism of expected utility theory is Kahneman and Tversky's framing effect (Kahneman, Tversky (1979), Tversky, Kahneman (1986)), since it shows that decisions are to be taken in a specific context, which has nothing to see with lotteries characteristics as probabilities and outcomes, and that this specific context matters. Of course, in expected utility, the context should not play any role and only the intrinsic characteristics of lotteries are to be considered. Famous cases of framing, inducing non rational preferences in the sense of expected utility, have been extensively studied by psychologists or experimental economists, such as preference reversal or loss aversion (see Lichtenstein, Slovic 1971 ; Grether, Plott, 1979 for preference reversal ; Kahneman, Tversky (1986, 1991) for loss aversion). More generally, the existence of framing effect is a major problem for the economic theory of choices because it demonstrates the difficulty of implementing revealed preferences methods in an empirical way. Economists postulate that preferences are independent from the manner it had been revealed. Indeed, the fact is that preferences depend upon the elicitation procedure which is being used. Economists have to deal with the consequence of framing on revealed choices, and specifically, about the impact that framing should have on individual's choice consistency over time.

The aim of this paper was twofold. First we analyzed consistency of choices under risk. The concept of consistency refers here to a specific idea. The consistency is the fact that individuals who exhibit a certain preference or utility function at a given point of time do not exhibit another preference or utility function later. More precisely, we adopted Holt and Laury's (2002) procedure to elicit individual risk preference and we built variants of this procedure in our different experimental treatments. The interest of Holt and Laury design, beyond its procedural simplicity, is that a consistent subject will switch from choice A to choice B for a given choice, enabling the experimenter to elicit level of risk aversion (CRAA index) and thus reveals roughly subject's utility function. That is, if any subject switches more than one time, she is inconsistent because she exhibits more than one functional form for her own utility. The second aim of this paper was to investigate to what extent framing also induce changes in risk behaviour, irrespective of inconsistencies. The impact of framing on choices under risk was analyzed by implementing two dimensions in the lab: Sequentiality in lottery choices and order in lottery choices.

Our results challenge the quantitative and to some extend the quantitative results of Holt and Laury (2002) and therefore the robustness of EUT assumptions. Our main result is the intensity of inconsistent responses over the different frames. Subjects reported their preferences with some inconsistent bias which is intensified by the sequentiality of responses. Inconsistency is very pronounced when information about the progress of the game are not available. This feature is very uncomfortable for EUT and for the assessment of Holt and Laury(2002) since subjects seem to consider the game as a whole and revise deficiently their preferences when decisions are reported separately (see Hey and Lee (2005)). The distortion between sequential and simultaneous responses is a matter of the lack of information that leads to a violation of the stochastic dominance. The other major result is the effect of incentives on the consistency of behaviour. Valuable financial incentives tend to lower the frequency and the scale of inconsistency whatever the frame. When payoffs in stake are important, individuals pay more attention to each question and make less error particularly when full information concerning the progress of the game is available. Incentives have therefore a central role on the consistency of behaviour because they enhance the performance of individuals.

This paper also presents the implications of the frame on the attitude toward risk. First, we observe that inconsistency tends to increase the probability of choosing the safe option. The direct implication of this result is that, contrarily to Holt and Laury's risk aversion estimates, consistent subjects are actually less risk averse. Second, we observe that sequential presentation of the lottery choice tend to increase risk aversion due to the confusion caused by the lost of needed information. Third, the framing is quite important for risk behaviour as subjects tend to be more risk averse when probabilities are presented randomly or decreasingly rather than ranged from 10 to 100%.

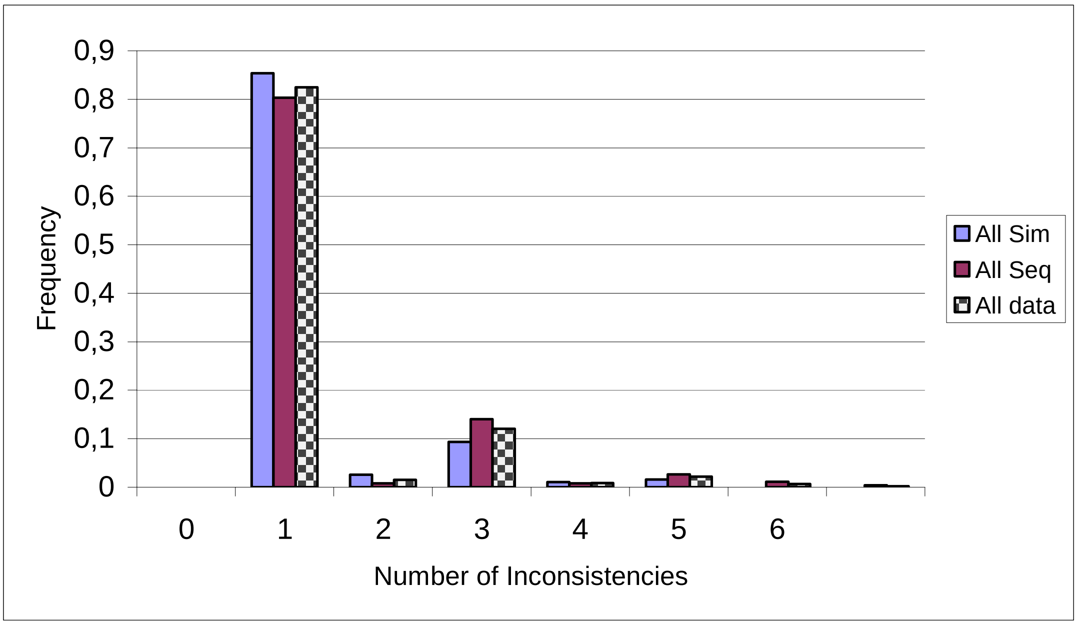


Figure 2.b. Number of Inconsistencies in the Sequential vs Simultaneous frames

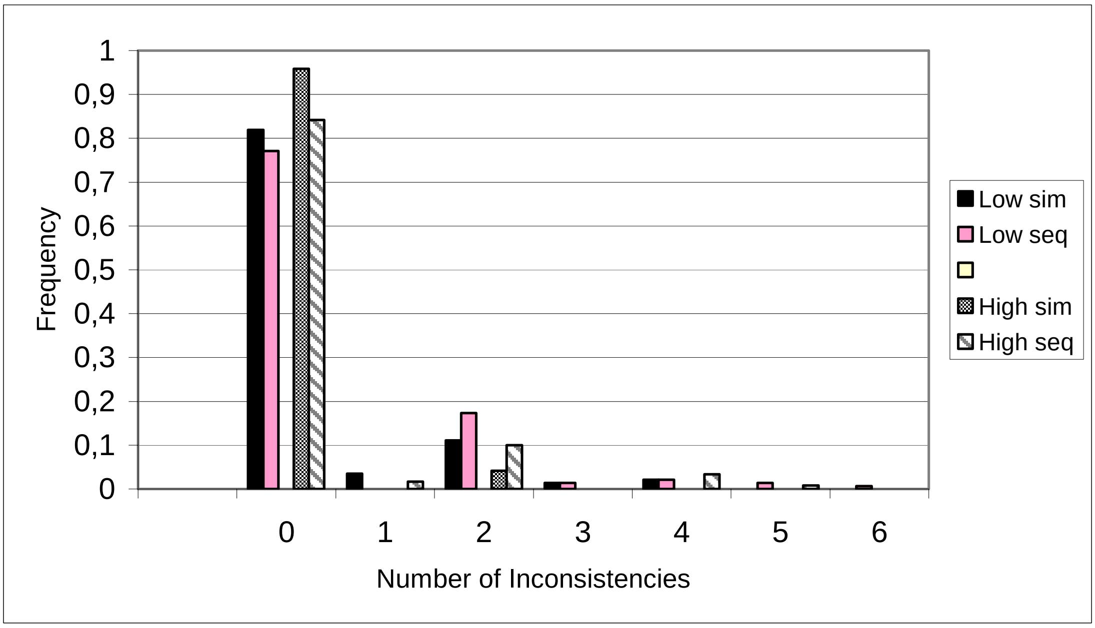


Figure 2.c. Number of Inconsistencies in the Sequential vs Simultaneous frames for low payoff and for high payoff

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