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The effect of elicitation methods on ambiguity aversion: an experimental investigation

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Abstract

In this paper we elicit preferences for the classical three-color Ellsberg Paradax employing three different methods, choices, minimal selling prices and maximal buying prices. The resulting data reveal a high frequency of preference reversals which have not been analyzed before in choice under uncertainty. Moreover, we analyze the effect of elicitation methods on the degree of ambiguity aversion. While there is no apparent difference in the attitude towards ambiguity between selling and buying prices we observe a rather distinct pattern of behavior for choices: Compared to choices, eliciting preferences by pricing tasks decreases the number of subjects being ambiguity averse in both tasks and increases the number of subjects being ambiguity neutral or prone. We argue that this difference between pricing and choice supports the hypothesis of comparative ignorance.

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1. Introduction

The preference reversal phenomenon is nowadays established in the literature as a rather robust phenomenon which clearly contradicts traditional preference theory. A preference reversal occurs for a given pair of lotteries if the choice ordering of a subject is systematically different from his or her price ordering. The usual case observed in practice is that subjects tend to state a preference for the safer lottery but state a higher selling price for the riskier one (Slovic and Lichtenstein 1968).

Another well established phenomenon in the experimental literature is the preference for risky lotteries when compared to uncertain (or ambiguous) ones as shown by the well-known paradoxes of Ellsberg (1961). Such a preference for risky lotteries is called ambiguity aversion. As far as we know, the preference reversal phenomenon has only been examined with risky but not with uncertain lotteries. Therefore, the relation between ambiguity aversion and preference reversal remains unclear.

In the experimental literature on ambiguity (Camerer and Kunreuther 1989 and Hogarth and Kunreuther 1989) it appears that ambiguity aversion is a more robust phenomenon when preferences are elicited through choices and not through a market mechanism (auction). We provide a direct test whether subjects who exhibit uncertainty aversion in Choice Tasks are sometimes ambiguity averse or neutral in Pricing Tasks. To do so, we elicit preferences with three different methods, Choices, Minimal Selling Prices and Maximal Buying Prices. It turns out that behavior in the two pricing tasks is quite similar while there is a clear difference between choice and pricing which is supporting the hypothesis of comparative ignorance (Tversky and Fox 1995). This hypothesis supposes that ambiguity aversion in choice tasks is mainly a result of a direct comparison of risky and ambiguous alternative. Since such a direct comparison is not possible in our pricing tasks ambiguity aversion should be less pronounced.

2. Experimental Design

The experiment was conducted at the Centre of Experimental Economics at the University of York with 24 participants. Each participant had to attend five separate occasions, A, B, C, D, and E with occasions A, B and C being identical. Each different occasion was offered on every single day with varying chronological order and the participants could choose on which days they attended which occasions.
Each of the occasions lasted between 25 and 40 minutes. The time varied not only between the single occasions but also across the subjects since they were explicitly encouraged to proceed at their own pace. After a subject had completed all five occasions one question of one occasion was selected randomly and played out for real. The average payment to the subjects was £34.17 with £80 being the highest and £0 being the lowest payment.

On each of the five occasions the subjects were presented with the same 30 lottery pairs - 28 risky and 2 ‘uncertain’ ones. In the present paper we are only concerned with the uncertain ones which were expressed through the three-colour Ellsberg Paradox with £30 as the possible prize. For both pairs first the following text appeared on screen: “Consider an urn which contains 90 balls, 30 of them are red, the others are either blue or yellow in an unknown proportion”. Then, the two choice problems were described as follows.

Problem I:
I1) You win £30 if a red ball is drawn from the urn and nothing if a blue or yellow ball is drawn.

I2) You win £30 if a blue ball is drawn from the urn and nothing if a red or yellow ball is drawn.

Problem II:

II1) You win £30 if a red or a yellow ball is drawn from the urn and nothing if a blue ball is drawn.

II2) You win £30 if a blue or a yellow ball is drawn from the urn and nothing if a red ball is drawn .

Subjects commit Ellsberg Paradox if they choose I1 in Problem I and choose II2 in Problem II, or choose I2 in Problem I and II1 in Problem II. In the first case they are called ambiguity averse while in the second case they are called ambiguity prone. According to Subjective Expected Utility subjects should be indifferent between I1 and I2 and between II1 and II2, in other words, they should exhibit ambiguity neutrality.

In occasions A, B, and C subjects were asked for both problems above to make a choice between the two lotteries. In occasion D they were asked for their Maximal Buying Price in a second-price sealed-bid auction while in occasion E they were asked for their Minimal Selling Price in a second-price offer auction.

In occasion D each lottery appeared alone on screen and subjects were asked: "Submit your bid for this lottery in a second-price sealed-bid auction." That is subjects were asked to assume they did not have the lottery and had to bid to get it. They had to type in their bid and confirm it by pressing the return key. If a question of occasion D was selected for the reward, the subject received a payment of £y where y is the highest amount in the corresponding lottery. Moreover, if the subject submitted the highest bid among all subjects in the group with whom he or she completed occasion D, he or she would additionally play out the lottery and had to pay the second highest bid.

Occasion E was identical to occasion D except that for each lottery a different question was asked: "Submit your offer for this lottery in a second-price offer auction". That is subjects were asked to assume that they owned the lottery and had to make an offer to sell it. If a question from occasion E was selected for the reward, the subject could play out the corresponding lottery. However, if he or she submitted the lowest offer among all subjects in the group with whom he or she completed occasion E, he or she received the second lowest offer instead of the lottery.

At the beginning of the occasion D and E, subjects received a three-page instruction sheet. Then an audio-tape of these instructions was played which took approximately ten minutes. The instructions clearly explained the rules and the incentive compatibility of second-price auctions.

In occasions A, B, and C there were two different screens for every lottery pair, though the second of these screens does not concern the analysis of this paper. On the first screen both lotteries of the pair appeared on screen and subjects had to indicate whether they prefer the left lottery, or the right lottery, or whether they are indifferent. After pressing the corresponding key they had to confirm their choice by pressing the return key. If the question on the first screen was selected for their reward they could play out the preferred lottery. In the case of indifference one of the lotteries was selected randomly by the experimenter.

To sum up, subjects had to perform three Choice Tasks and two Price Tasks for both lottery pairs. All the three choices and both prices were elicited employing incentive compatible methods.

3. Results

Let us first compare the behavior of our subjects in the three different tasks. Table I shows for both choice problems the percentage of subjects who exhibit ambiguity aversion, proneness, or neutrality in the Choice Task, in the Selling Price Task and in the Buying Price Task. As a first result, we can see that 54.2 % of our subjects displayed ambiguity aversion for both problems I and II in the Choice Task while this is true only for 16.7 % in the Selling Price Task and in the Buying Price Task. On the other hand, we can observe that the number of subjects displaying ambiguity neutrality is much higher in both Pricing Tasks compared to the Choice Task. In addition, no subject exhibits ambiguity proneness when choosing between lotteries while there is some ambiguity proneness in both Pricing Tasks.

Altogether, Table I shows that eliciting preferences through Pricing Tasks instead of Choice Tasks

- decreases the number of subjects being ambiguity averse in both choice problems,
- increases the number of subjects being ambiguity neutral,
- and increases the number of subjects being ambiguity prone.

According to chi-square tests all three differences are statistically significant at the 1% level for both, selling and buying prices

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The three results can be explained as follows. The main difference between the Choice Task and both Price Tasks is the fact that in the Choice Task both lotteries of each pair appear simultaneously on screen while all four lotteries have to be evaluated separately in both Price Tasks. In other words, in the Choice Task subjects can directly compare the risky and the ambiguous lottery of each pair while this is not possible in the Price Tasks. Therefore, our results support the hypothesis of comparative ignorance of Tversky and Fox (1995). Comparative ignorance implies that direct comparison of risky and ambiguous alternatives enhances the degree of ambiguity aversion.

Table I: Overall Behavior

		Problem I									
		Ambiguity Averse			Ambiguity Prone			Ambiguity Neutral			Inconsistent
		Choice	Selling	Buying	Choice	Selling	Buying	Choice	Selling	Buying	(Choice)*
Problem II	Ambiguity Averse	54.2	16.7	16.7	-	12.5	12.5	8.3	-	4.2	8.3
	Ambiguity Prone	-	8.3	20.8	-	8.3	8.3	-	12.5	8.3	-
	Ambiguity Neutral	-	8.3	4.2	-	4.2	-	12.5	29.2	25.0	-
	Inconsistent (Choice)*	12.5	-	-	-	-	-	-	-	-	4.2

*Different preferences in the three choice occasions are called “inconsistent “.

In the following analysis we are going to consider only subjects who were consistent in all three choice occasions and were not indifferent. All these subjects committed the Ellsberg Paradox and show ambiguity aversion. We will compare this result with what we can infer from subjects´ evaluation of the same lotteries in the two Pricing Tasks.

Table II reports for both Pricing Tasks the percentage of subjects with a given attitude towards uncertainty for problem I while Table III reports the same percentage for problem II. We are going to comment first on the relation between the Choice Task and Minimal Selling Prices, then on the relation between Choice Task and Maximal Buying Prices and last on the relation between Selling and Buying Prices.

Table II: Preference Reversal for Lottery Pair I

	Ambiguity Averse	Ambiguity Prone	Ambiguity Neutral
Selling Price	37.5	31.2	31.2
Buying Price	50	18.8	31.2

Table III: Preference Reversal for Lottery Pair II

	Ambiguity Averse	Ambiguity Prone	Ambiguity Neutral
Selling Price	35.3	35.3	29.4
Buying Price	47.1	41.2	11.8

Looking at Table II, we can see a clear change of attitudes towards uncertainty. Only 37.5 % of our subjects in the Selling Price Task and 50 % in the Buying Price Task keep their aversion towards uncertainty revealed in the Choice Task. The rest of the subjects either show proneness or neutrality to uncertainty. This reversal in preference has never been analyzed in the literature on choice under uncertainty. It can be observed also for problem II in Table III. In this case only 35.3 % of subjects in the Selling Price Task and 47.1 in the Buying Price Task show consistency with the preferences revealed through the Choice Task. Therefore, we can conclude that the preference reversal phenomenon is also a robust pattern of behavior in choice under uncertainty.

When we compare the change in preference between the Choice Task and the two Pricing Tasks we can see in Tables II and III that the percentage of people changing their own preferences is higher in the case of Selling Prices than in the case of Buying Prices. A chi-square test confirms that this difference is statistically significant at 5% level for both lottery pairs. This difference can be explained by the hypothesis that people may show a higher degree of pessimism when buying a lottery than when selling it. Note that also for risky lotteries Schmidt and Hey (2004) observed a higher number of preference reversal for Selling Prices than for Buying Prices. Therefore, this observation carries over to ambiguous lotteries.

4. Conclusions

In this paper we elicited preferences for the classical three-color Ellsberg Paradox with three different elicitation methods, Choices, Minimal Selling Prices and Maximal Buying Prices. We observed a high incidence of ambiguity aversion in the Choice Task whereas ambiguity aversion is less pronounced in the Pricing Tasks. This evidence supports the hypothesis of comparative ignorance as the risky and ambiguous lottery can be evaluated jointly in the Choice Task but only individually in the Pricing Tasks. As a consequence of the changing extent of ambiguity aversion we can also observe preference reversals in choice under

uncertainty which have not been discussed before in the literature. A well known explanation of preference reversal is the hypothesis of scale compatibility by Tversky et al. (1990). According to this hypothesis people focus more on the monetary outcomes of lotteries in pricing (since there the response scale is given in monetary units and comparing money to money needs less cognitive effort than comparing money to probabilities) whereas they focus more on probabilities in choice. Applying this to our results, a higher focus on probabilities in the Choice Task may lead to a larger degree of ambiguity aversion if people dislike unknown probabilities. Altogether, according to our results, ambiguity aversion has a similar impact than risk aversion in the context of preference reversals: Both, the impact of ambiguity aversion and risk aversion seems to be higher in Choice than in Pricing Tasks and lower for Selling Prices than for Buying Prices.

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