

## Behaviour under Uncertainty without Preference Reversal: A Field Experiment

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*Abstract:* The robust laboratory evidence of preference reversal for lotteries has been interpreted as a threat to the general validity of standard theories of decision-making under uncertainty. This evidence is obtained from laboratory, that is, not real-world, lotteries with subjects who have not sought to make decisions among such lotteries. Here, the prevalence of preference reversal is studied in a field experiment with used cars, that is, a case of real-world non-trivial, non-lottery – but still payoff-uncertain – choice objects, and with subjects who registered as potential buyers of such cars. No sign of preference reversal was observed.

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Inconsistency between choice and valuation – or preference reversal – was first observed by psychologists in laboratory experiments with lotteries at the beginning of the 70s. Their reports met with scepticism from economists, partly perhaps because preference reversal would mean a blow to a vital part of standard economic theory. However, once preference reversal was replicated by economists in lottery experiments, which were carefully checked against a set of potential mistakes in experimental design (see Grether and Plott, 1979), the phenomenon has been accepted by a large number of economists. For some time now a major preoccupation in this field has been to find an explanation of the phenomenon. Is it the transitivity, independence, asymmetry or some other axiom that is violated by preference reversal (see Loomes and Sugden, 1983, Holt, 1986, Karni and Safra, 1986, Machina, 1987, Segal, 1988, Cox and Epstein, 1989, and Loomes, Starmer and Sugden, 1989)? How much of standard decision theory can be saved? Examinations of these questions have found their way into leading economics journals, thus “confirming” the relevance and seriousness of the problem. No wonder, perhaps, since Grether and Plott argued in their seminal article that the inconsistency implied by preference reversal “is deeper than the mere lack of transitivity... It suggests that no optimization principles of any

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sort lie behind even the simplest of human choices and that the uniformities in human choice behaviour may result from principles which are of a completely different sort from those generally accepted" (Grether and Plott, 1979, p. 623).

Preference reversal has been identified in a number of laboratory tests and a common verdict now is that the evidence is "robust". The psychologists Lichtenstein and Slovic, who were the first to discover preference reversal, have more recently advised economists to "accept the reality of preference reversals and related information-processing phenomena and ... explore their implications for important social and economic behaviors" (Slovic and Lichtenstein, 1983, p. 602). Nevertheless, the nature of the laboratory evidence is such that there is still considerable uncertainty as to what real-world phenomena the robust evidence is actually valid for, and exactly what we are invited to accept as fact. More specifically, do we know for a fact that preference reversal occurs in situations of choice with uncertain payoffs other than those situations – essentially laboratory lotteries – for which it has been found to hold?

Here, we report on a field experiment where preference reversal does not arise. In this experiment, choices refer to a non-lottery (but still outcome-uncertain) message space involving non-trivial values for decision-makers.<sup>2</sup> In addition, and in contrast to earlier experiments, the choices observed are those made outside the laboratory, in the sense that decision-makers, in their own self-interest, *seek* these choices. It is, of course, primarily for such situations that we want the theory to be applicable. However, when it comes to creating incentives for truthful reporting of preferences as well as truthful reporting of reservation prices in such tests, we will not be able to leave completely the laboratory nor the lottery context; in fact, it remains to be shown how the combination of such data can be obtained from the field. Still, the test objects or – in the terminology of laboratory experimentalists – the message space of the experiment presented here are not lotteries but used cars, notoriously uncertain in their provision of future services to their users.

In Section I we give the background to the choice of the experimental design, the details of which are presented in Section II. The results of the test are set forth in Section III. The implications of these results are discussed in a concluding section.

## **I The Objective of the Experiment**

Typical for most of the experiments used for testing preference reversal are choices between a P bet (a lottery with a high probability of winning a small

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<sup>2</sup> For a definition of "message space" see Smith (1982).

amount, say, a 35/36 chance of winning \$4 and a 1/36 chance of losing \$1) and a \$ bet (a low probability of winning a relatively large amount, say, a 11/36 chance of winning \$16 and a 25/36 chance of losing \$1.50) and eliciting selling reservation prices for each of these lotteries.<sup>3</sup> Preference reversal, that is, subjects stating lower prices for the preferred lottery, has typically been observed in more than 30 percent of the cases and as much as some 70 percent of the cases where P bets are preferred. The most important characteristics of these lotteries can be summarized as follows:

- a) Only “homemade” lotteries have been used as choice objects. They do not represent real-world lotteries, primarily because (1) the price for the laboratory lottery ticket is zero, implying an expected loss for the lottery organization, (2) there is only one (positive) prize, and (3) prizes are trivially low. P bets of the kind used in these laboratory experiments are those for which preference reversal has been most prominent by far, but also those particularly hard to imagine as attractive lotteries in the real world. Since there is only one prize and, in this case, a probability of winning well above 1/2 and since real-world lotteries typically return as little as 50 percent of receipts as prizes, the prize can barely exceed the price of the lottery ticket.
- b) The experimental lotteries do not well represent objects central to the theory of decision-making under uncertainty, such as financial assets, contingent contract for delivery of services, insurance policies and products with uncertain service prospects, for which there are no objective probabilities for different outcomes. Moreover, there are typically more than two outcomes for such choice objects.
- c) As already noted, outcomes, that is, lottery prizes, have typically been insignificant. Thus, also the expected values of the laboratory lotteries have been very small. In addition, the difference between the expected values for the two lotteries, which the subject is asked to choose between and state reservation prices for, have in most cases been trivial. (In the example given above, the difference between the expected values is one cent.) In such cases, preference reversal may simply be the result of lack of saliency.
- d) Subjects have been asked to participate in experiments concerning decision-making under uncertainty often without being told that they are supposed to choose among lotteries. Moreover, they are typically promised a payment for participating. Noting (1) that decision-makers who do not want to buy lottery tickets may behave in a way that systematically differs from those who do and, if so, (2) that theory of decision-making refers only to the latter of these two groups, we have no way of knowing to what extent participants belong to the latter group, and specifically, to what extent preference reversal occurs in that particular group.

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<sup>3</sup> This representative example is taken from Grether and Plott, *op.cit.* For a fuller presentation of the history of preference reversal experiments, see e.g. Loomes, Starmer, and Sugden, 1989.

The objective of the experiment to be presented here is to try to avoid the characteristics mentioned above. First, the objective is to observe the consistency between choice and reservation prices concerning *non-trivial* objects the future performance of which can take on *many alternative* states or values and where the probabilities of the occurrence of these states are *subjective* only. Second, the objects were such that, due to expected differences in individual preferences, all subjects would hardly *want to* rank them in the same order and *few* subjects would be *indifferent* between them. Third, an attempt was made to use as subjects people who actually *seek* to make decisions concerning the choice objects used.

A test was arranged where the choice objects were used cars, that is, objects for which the future performance or service prospects are uncertain. Two cars – one capable of being a P bet and the other a \$ bet – were bought by the experimenters in the open market for some \$1,200 (SEK 8,000)<sup>4</sup>, a price that was not disclosed to the participants. This type of cars, more than ten years old and run for more than 180,000 kms, does not have a precise market price; depending on the quality of such old cars the price could be anything from, say, \$2,500 down to zero (or lower). The cars were to be auctioned off. Interested students were invited to participate in the auction.

## II The Experimental Design

The test was arranged as follows:

1. In mid-May, students at the University of Stockholm were told through information sheets handed to them that those interested in buying “an inexpensive used car” should check the cars offered for sale by the Department of Economics as a part of a study of buying behaviour at this department. To be eligible, participants had to have a driver’s license and be able to attend a couple of meetings, one for explaining the auction procedure that was to be used, one for test driving the cars and one for the real auction (see Appendix A for the leaflet text.) About 1500 copies were distributed. Thirty-three responded by returning signed leaflet coupons. Twenty-six persons completed the test, most of them students of Business Administration (11) and Economics (9); only 6 (23 percent) came from other disciplines (Computer Science 2, Mathematics, Chemistry, Geography and Statistics, 1 each).
2. The information meeting, held a couple of days later, took 30 minutes. The participants were told that two cars (so far unspecified) were available, one of

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<sup>4</sup> All amounts are in 1990 prices.

which might actually be *given* away in a lottery! Thus, possibly only one would be auctioned off. All this would take place five days later. For the lottery, we needed to know which car they preferred or whether they were indifferent between the two cars.

- a) A first lottery would select a “winner” (the registration number of a participant). The winner would have a  $2/3$  chance of winning the preferred car and a  $1/3$  chance of winning the other car. (Or  $1/2$  chance for each car, if the winner had indicated indifference.)
  - b) Once the prize car had been identified (through the second lottery just indicated), a third lottery was used to determine whether the winner would be allowed to keep the car (chance  $1/2$ ) or receive the price he had offered for this car (chance  $1/2$ ). Therefore, when asked to state their *buying* prices for each car, subjects were told that their bid would be used also as their *selling* price, in case they turned out to be the winner (eventually a  $1/26$  chance) and the prize car had to be resold (eventually a  $1/52$  chance). In this latter case, the car would be auctioned off, the highest bidder paying the second highest bid and the winner receiving a prize equal to his bid for this car. (The experimenter would receive the difference between the price paid by the highest bidder and the winner’s bid.)
3. Thus, the subjects were told that, at the final meeting, they would be asked to state in writing (a) their preferences and (b) their bids (for the forms used, see appendix B). Moreover, they were explicitly asked to check both statements before turning them over to the experimenter.
  4. Subjects were told that auctions would be of the second-price type and also what that meant in terms of incentives to state their willingness to pay as compared to the case of first-price auctions (see e.g. Vickrey, 1961).
  5. At the information meeting,
    - a) all important information was repeated; a hypothetical trial run was arranged, observing all essential formalities (with bicycles as choice objects for illustration),
    - b) information was provided about special cases such as
      - the possible existence of more than one highest bidder,
      - the lottery winner also being the highest bidder on a prize car (if it was to be auctioned off),
      - the winner of a car “for keeps” also being the highest bidder on the second car (the person who got the first car would be automatically excluded from the second round), etc.
    - c) a memorandum was distributed at the end of the meeting, summarizing the main points of the oral information given and including “reminders” such as (i) that they should take into account that the cars might be of

- interest to them either for their personal use or as a piece of property for (immediate) sale on the open market and (ii) the double role of the bids as a buying price and a potential selling price (see Appendix C),
- d) people were told *now* that, if they returned for the final meeting and completed their statements, they would receive SEK 50 (about \$8) for participating, and
  - e) participants signed up for test drives some time during the next 48 hours.
6. Finally, the car models were identified to the participants. Furthermore, copies of the test results from *two* inspection-stations (one test very detailed) of each car were given to the participants. As already mentioned, it was never disclosed what the cars cost us to buy or that we had chosen cars which had the *same price* (SEK 8,000).<sup>5</sup>

The test – or, as it would now appear to the informed participants, the lottery-preceded auction – was carried out as indicated and as specified in Appendix C.<sup>6</sup>

Some important points of the test design should now be explained:

*Why a lottery and why give away a car?* We had to make it worthwhile for the subjects to reveal truthfully their preferences for the two cars. A lottery – with a significantly higher probability of winning the preferred car (if one car is preferred) than the one not preferred – was arranged for this reason.<sup>7</sup>

It should be noted here that the incentive mechanisms provided by this lottery and the other two (see below) imply that subjects, when choosing between cars, are asked to choose between two compound lotteries. Most previous laboratory tests also involved choosing between compound lotteries. But the important difference is that the objects in message space – or the explicit choice objects – no longer are lotteries but used cars.

*Why give any chance of winning the car not preferred and why introduce the possibility of winning the money value of the bid on this car?* The reason is that this adds to the incentive to make a well-considered bid also on the least preferred car. (Should preference reversal appear, it would be important to know if bids on the two cars were close or wide apart.) Now, bid levels are important for the subject if he turns out to win – not a car – but the money value of his bid for

<sup>5</sup> The task of a preference-reversal analyst is of course to avoid a set of alternatives (a) for which preference reversal would not really surprise anyone (that is, where the decision-maker finds the two objects so similar that he does not care whether he states preference for one object or the other or whether he makes bids that are almost but not exactly equal; cf. Pommerehne et al. 1982, and Reilly, 1982) or (b) for which absence of preference reversal is self-evident (as with a fairly new Rolls Royce and an old VW Beetle). Our choice of cars was made in an attempt to create a test situation that avoids these two extremes.

<sup>6</sup> Details of the manuscript of the experimenter's oral presentation are available on request.

<sup>7</sup> To reiterate: The prospect of winning a car or its money value – as well as the existence of a remuneration for participation – was not made known to potential participants before they registered. Hence, it is still possible to regard all participants as real consumers, that is, people interested in buying an inexpensive used car, and not as gamblers or income earners.

this car. Of course, incentives to make careful bids exist already for both cars, *provided* the respondent thinks he stands some chance of coming out on top in an auction of any one of them. This proviso is important, in particular perhaps concerning the car of his second choice, that is, the car he does not think so highly of. If, on the other hand, he feels more or less certain that his true highest bid is far below the top bids made by others -- not unlikely perhaps since he does not fancy this car -- he may not feel inclined to devote time and energy to investigating what his willingness to pay (WTP) for this car is. Introducing the fact that he may win the money value of his bid on the car he does not prefer, he is likely to consider more carefully his bid on this car, for example, by taking the trouble of obtaining outside information about what he could get for the car on the open market.

Could using bids also as selling prices in the way now described stop bids from being set equal to WTP, the dominating bidding strategy of the second-price auction? There is a  $1/78$  chance ( $2/3 \times 1/2 \times 1/26$ ) that the bidder will win the first lottery *and* get the money value of his bid on the car he prefers or, more important for preference reversal, a  $1/156$  chance that he will get the money value of his bid on the least preferred car. These small chances would hardly make him raise his bid on any of the two cars above this WTP, since this would mean that he runs a risk of winning an auction at a price exceeding his WTP.

*Why not ask for selling prices* especially since this is what we really want, recalling that preference reversal arises and expected-utility theory is contradicted if the less-preferred car has the higher *selling* price? Any design we could think of, creating a real demand for a selling price to be used in an auction of the car prize, would provide incentives for making distorted statements. More specifically, the reason for not asking for (separate) selling prices is the potential presence of speculative considerations, creating a risk for false observations of preference reversal. For example: Car A is preferred by a person who, in addition, believes that others have a relatively much higher WTP for car B and state higher *buying* prices for car B than he does. Hence, maximizing his expected payoff, this kind of speculation can make him report a higher *selling* price for B than for A, his preferred choice.

*Is it acceptable to substitute the rank order of buying prices for the rank order of selling prices?* The incentive for truthfully reporting buying prices is the assumption that nobody likes to end up paying more than his WTP and that nobody -- in a second-price auction -- would like to make bids understating his WTP. One major reason why the buying price under the given conditions could still deviate from the selling price is related to the role of income effects. Especially, since the significance of the choice objects is one of the aspects emphasized and strived for in this study, it would not be surprising, of course, if income effects turned out to be significant.

First, however, it should be noted that the only income effects that would be troublesome here are those which would cause an unobserved *shift* from preference reversal to lack of such reversal (or vice versa). But income effects are

unlikely to change the *rank order* of reservation prices, be it selling or buying prices, for such close substitutes as used cars of about the same age and “market price”.

Second, the income effects may after all be rather limited, given that the market price for the cars, SEK 8,000, (although not mentioned to the participants) is likely to be the upper bound to the bids and that the minimum annual budget of a student contemplating the use of a car is likely to be on the order of SEK 50,000. Hence, winning one of these two cars would mean a net addition to “income” of at most some 15 percent. Furthermore, the relevant income concept is certainly elusive here, since it could be argued that expenditure during the years of university training should be related to income during a number of years, possibly even expected life-time income. In the perspective now proposed, it hardly seems controversial to make the assumption that the selling price for a car, if you had won it and thus had your “income” increased with this prize, equals approximately the buying price at the initially given income.

Summing up, it seems unlikely that disregarding (small) income effects would distort the observed rate of preference reversal. It might be added that in some of the previous preference reversal experiments both buying prices (or “equivalents”) and selling prices were elicited (for example, Slovic and Lichtenstein, 1968, Lichtenstein and Slovic, 1971, and Grether and Plott, 1979). A considerable rate of preference reversal was observed also for buying prices (sometimes higher and sometimes lower than for selling prices), indicating that the use of buying prices did not stop preference reversal from arising in lottery experiments.<sup>8</sup>

### III Results

The choices and bids are shown in Table 1, with the bid for the preferred car underlined. As it turned out, the winner in the lottery got the car he did not

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<sup>8</sup> All risks that preference reversals go unnoticed have not been possible to avoid with the experimental design used here. Assuming that an individual is a preference reverser, so that he actually prefers car A to car B and would like to state a price for B,  $p(B)$ , higher than that for A,  $p(A)$ , it may happen that he now wants to state a preference for car B. The reason is as follows: By choosing to state B he increases the chances of winning the money value of B ( $\approx$  his bid on B) which is higher than his bid on A. More specifically, in the particular case of preference reversal where he values the difference  $p(B)$  vs  $p(A)$  more than car A vs car B, he would indeed want to state a preference for B. – The problem with this line of reasoning, however, is that the rationality that is assumed for his choice of response just indicated was not assumed to hold for his “actual” preferences for the cars and his “actual” reservation prices. Once we wish to deviate from one implication of standard theory (assuming preference reversal behavior), it is hard to know when, if ever, other implications of that theory can be relied upon to hold.

**Table 1.** Bids (in SEK) and preferences (indicated by figures underlined)

Participant no.	Opel	Volvo	Participant no.	Opel	Volvo
1 <sup>c</sup>	1,100	1,100 <	14 <sup>b</sup>	1,000	<u>1,500</u>
2 <sup>c</sup>	500	<u>1,000</u>	15 <sup>b</sup>	2,000	<u>2,600</u>
3 <sup>c</sup>	4,300	<u>4,300</u> <	16 <sup>e</sup>	6,100	<u>6,100</u> <
4 <sup>b</sup>	500	<u>3,800</u>	17 <sup>a</sup>	1,200	<u>3,100</u>
5 <sup>a</sup>	1,100	<u>1,200</u>	18 <sup>b</sup>	500	<u>700</u>
6 <sup>b</sup>	2,600	<u>3,300</u>	19 <sup>c</sup>	500	<u>600</u>
7 <sup>c</sup>	3,400	<u>6,900</u>	20 <sup>b</sup>	1,000	<u>1,600</u>
8 <sup>b</sup>	<u>600</u>	500	21 <sup>b</sup>	1,800	<u>2,200</u>
9 <sup>a</sup>	1,000	<u>3,000</u>	22 <sup>c</sup>	2,000	<u>2,000</u> <
10 <sup>c</sup>	900	<u>1,200</u>	23 <sup>b</sup>	500	<u>3,800</u>
11 <sup>c</sup>	<u>2,500</u>	2,000	24 <sup>b</sup>	100	<u>300</u>
12 <sup>b</sup>	<u>1,400</u>	1,300	25 <sup>a</sup>	<u>5,600</u>	3,600
13 <sup>a</sup>	<u>3,300</u>	3,300 <	26 <sup>c</sup>	3,000	<u>5,400</u>

(Indices show subjects as students of Business Administration (b), Economics (e) and from other disciplines (o). Equal bids are marked by <.)

Note that participants were anonymous to one another, that they could not check what statements and bids others made, but that they could communicate as much as they wanted from their first contact on May 24 (if they already knew each other or got acquainted then) to the final meeting on May 29 (cf. respondents 4 and 23 for a possible example of the results of a "coalition".) The possibility of an enforceable coalition among all participants was negligible.

Note also that only even SEK 100 bids were accepted; participants were told that noncompliant bids would be lowered to the nearest SEK 100 (which turned out to be necessary in one case only, no. 17).

prefer (an Opel 1977) "for keeps". Hence, only one of the cars, a Volvo 1976, was auctioned off. The highest bid here was SEK 6,900 and the second bid, hence the price paid, was SEK 6,100.<sup>9</sup>

Only one participant (No. 1) stated indifference between the cars. He and another four participants gave bids which did not discriminate between the cars. Thus, four persons indicated strict preferences but did not differentiate their bids between the cars; we shall return to this case below. However, no case of preference reversal occurred.

Only five out of 26 participants preferred the Opel; 20 preferred the Volvo (see Table 2). This result requires some comments: To begin with, it should be noted that the Volvo had been chosen by us as a candidate for the possible role of a P

<sup>9</sup> The fact that some subjects gave "ridiculously" low bids – as low as SEK 100 (no. 24) – should not be regarded as a proof that the incentives discussed in the preceding section are ineffective. There are certain used cars, of course, which some potential buyers would hardly touch, let alone be found trying to sell to someone else. To such a person, SEK 100 may be his absolute max WTP for the car concerned. (Or if one would like to limit the applicability of consumer theory to "serious" customers, one might consider excluding such outliers.)

**Table 2.** Relations between choices and bids

	Choices	Bids		
		Consistent	Inconsistent	Equal
The Volvo	20	17	0	3
The Opel	5	4	0	1
Indifferent	1	(1)	0	(1)

bet (a large probability of making a small gain) in the world of non-lottery objects with uncertain service prospects. This particular choice is backed by the fact that Volvo, a product of Sweden, in this country is considered (a) to be reliable and (b) – by young people, at least – to be a rather dull car. The other car, a “luxury” version of the Opel Rekord (inside much nicer than the Volvo – with theater-red plush upholstery and a good radio) was selected as a car that could appear as a \$ bet (a small probability of making a large gain, relatively speaking!). More specifically, it would provide “high-quality” transportation services – if it kept going!

Now, as it happened, the Opel gear box broke down when test driven – which everybody except the experimenters thought was funny. (In view of the fact that these old cars were to be – and was – test driven by all subjects, we were aware of this risk and had arranged with a repair shop to have repair needs taken care of right away.) In spite of the fact that the gear box was repaired and provided with a warranty, there was a risk, of course, that the reputation of the Opel was seriously hurt by this incident. If so, the Volvo would be the obvious first choice.<sup>10</sup> However, it must be noted that – aside from the fact that five persons actually preferred the Opel – a fairly large number of subjects gave the same or almost the same bid on the two cars: in all, 15 subjects made bids differing by less than SEK 500. (Check also Table 3, where average bids on the first choice are shown to be almost the same, and the average bid on the second choice was clearly below that of the first choice, regardless of what the first choice was.) This hardly indicates that the Volvo was regarded as the obviously and generally better car of the two.

**Table 3.** Average bids

Average bid by those who prefer	the Volvo	the Opel	Neither	Total
For the Volvo:	2,730	2,140	(1,100)	2,554
For the Opel:	1,750	2,680	(1,100)	1,904

<sup>10</sup> It should be noted here that one of the test-stations used reported some 50 deficiencies on each of the cars (using new cars as their standard of comparison). These reports along with the age and appearance of the cars clearly told the participants that both cars were capable of breaking down.

It should also be noted here that, given the interpretation of the Volvo as a P bet and the Opel as a \$ bet, preference reversal has previously been observed primarily for those who rank P bets before \$ bets. A typical example: in their main experiment with incentives, Grether and Plott observed preference reversal in 70 percent of the choices ranking the P bet first and in only some 15 percent of the choices ranking the \$ bet first. Therefore, to test whether preference reversal at all arises in the context of used cars, we would welcome a large number of observations where P bets are preferred. As it turned out in the test presented here, most choices involved ranking that alternative first which is, at least potentially, a P bet.

Four out of 26 subjects constituted what we may call cases of “weak” preference reversal in that they preferred car A to car B while stating bids,  $p(A) = p(B)$ . Could this be regarded as something along the road to “strong” preference reversal? Not necessarily. First, prices or bids are relatively difficult to specify even when preferences are clear and, hence, easy to state. And bids (how much?) take more time than choice (yes/no) to specify. Hence, in principle, identical bids are compatible with strict preferences. Second, budget constraints may bind the bids to one and the same for both cars, although one of the cars is strictly preferred and would command a higher bid in the absence of a binding budget constraint. Thus, it does not seem possible to make anything significant out of this part of the results.

#### IV Concluding Comments

How do the results obtained here square with the results obtained earlier indicating preference reversal?

One possible explanation (pointed out by Harrison (1988) and to some extent already by Pommerehne et al. (1982)) for the preference reversals observed and reported on in the literature is related to the fact that in most of the laboratory tests, the costs of behavior inconsistent with theory have been trivial and so have the incentives to identify and report correctly preferences as well as bids (reservation prices). In contrast, given that the objects were more valuable in the test presented, participants are likely to have been more careful when judging the objects.

Another possible explanation springs from the hypothesis that (laboratory) lotteries constitute a quite special message space and fail to work well as stylized situations of choices between uncertain alternatives in general. The possibility of gambling being something special is reminiscent of the time when it was believed to be “paradoxical” that one and the same individual bought both insurance and lottery tickets, that is, seemed to be a risk lover and a risk averter at the same time. The paradox disappeared once it was realized that gambling

could represent something generically different from insurance (entertainment?). Similarly, the explanation here could be that pure gambling alternatives do not well represent objects with uncertain outcomes in general. More specifically, it is now possible to argue that *preference reversal cannot be seen as a problem for behaviour under uncertainty in general as long as preference reversal has not been replicated in non-gambling situations.*

One may wonder why economists have not paid more attention to the issue of whether or not preference reversal exists outside a rather limited set of artificial environments before setting out to identify possible explanations for preference reversal under uncertainty in general (for references see the Introduction). One could, of course, take the position that preference reversal in laboratory lotteries is important *per se*. This argument could run as follows: Proponents of expected utility theory have not made reservations for certain areas of application where the theory does not hold; hence, it is important that the theory is tested for all kinds of applications, including artificial lotteries. Accepting or rejecting a position like this is essentially a matter of taste. But what is clear from the existing literature, quoted in the Introduction, is that the preference reversal issues tested in the laboratory have been taken by many, not (only) as something interesting in its own right, but as a valid representation of a wide class of real-world issues. The obvious problem with that position is that it overlooks the fact that some effort must be devoted to ascertaining explicitly what the laboratory tests actually are taken to represent.

We have seen here that the experience of preference reversal from lottery experiments need not have anything to say about the frequency, or even the existence, of such behavior outside laboratory lotteries. Therefore, for preference reversal to be acknowledged as a blow to expected-utility theory and as a general problem that decision theory has to come to grips with, real-world issues must be identified where preference reversal is actually shown to exist.

## Appendix A Information Leaflet

The following text (with a different layout) was distributed to some 1500 persons, in and around the main student restaurant on the Stockholm University campus:

"In connection with a study of buying behaviour carried out at the Department of Economics, we ask ... Are you

**INTERESTED IN BUYING AN INEXPENSIVE USED CAR FOR THE SUMMER?**

If so, you have quite an *opportunity now!*

We have two cars both conscientiously tested by an “M”/corresponding to the AAA/ test station. Both cars can be test driven. Will be sold to the highest bidder. But – note – the price will be lower than that of the highest bidder!

If you are interested, complete the form attached below and return it to us/when and how/.

If the number of people interested is large, a random sample of participants will be drawn. Participants will be summoned to a 45-minute information meeting on *Wednesday, May 24 at noon*. The cars can be test driven when convenient during the period *May 24 p m to May 26 p m*.

The sealed-bid auction will take place on *Monday, May 29 at noon*. Takes some 45 minutes.

For participation it is required that you have a driver’s licence and can attend the meetings mentioned! If you meet these requirements and are interested –

***COMPLETE THE REGISTRATION FORM AND RETURN IT TO US AS SOON AS YOU CAN!***

### ***REGISTRATION***

I am interested in buying an inexpensive and tested used car. I can participate in the meetings mentioned! I have a driver’s licence. Right now I am a student/employed at ..... Department.

(Room for signature, name in block letters, address, telephone – no. and hours)

### **Appendix B Forms for Preference Statements and Bids**

*Preference statement:*

“I prefer ...! (State the make of the car.)

No, I think they are equally good! (In that case check here //!)

Signature”

*Bids :*

/Note that the form used in the trial run did not specify the makes of the cars. The wording also reflected the fact that it was a trial run. The final version of the form ran as follows:/

“My bid on the Opel with license plates X is SEK ...

My bid on the Volvo with license plates Y is SEK ...

I am aware of the fact that these bids are binding. (The cars will be sold in the fashion stated in the memo distributed after the information meeting on May 24.) I understand that the highest bidder will get the car that is auctioned off -- if not this person has obtained a car in an earlier round and therefore been eliminated from further participation. I hereby declare that, if the highest bidder, I will make a downpayment of SEK 1,000 and complete the purchase on May 30, at the latest.

Signature

*NOTE THAT THE TEXT MAY NOT BE ALTERED”*

### **Appendix C Information, Presenting the Main Points of the Instructions in Writing, Distributed at the End of the Information Meeting**

A selection:

“.....

2. You will get two forms to complete. The *light-green* one looks like this: /See the first part of Appendix B for text inserted here/  
The *white* one looks like this: /Appendix B, second part!/  
3. We want you to complete both forms, sign and state your name in block letters. Check your statements carefully!

Remember

- a) that you cannot get more than one car; the reason is that the person who gets the first car will be left out from the auction of the second car. Thus, you can state your highest price for both cars knowing that you will get, at most, one.

- b) that, when stating your bids, you may want to consider two ways in which you could use a car: keep it, of course, or resell it right away.
  - c) that your bids will have to be stated in even SEK 100s; we will reduce uneven bids to the nearest SEK 100 figure.
  - d) that the bid you state for each car determines (1) whether you get the car (the highest bidder gets it) and (2) the *amount* you receive *if* you win the lottery and *if* the car you win must be auctioned off (determined by tossing a coin) and *if* someone other than you has the highest bid on this car; since your bid thus has two potential “roles” to play, it seems appropriate to suggest that you carefully consider your bids.
  - e) that it is also important to consider carefully the order in which you want to rank the cars, since this order determines what car you are most likely to get – or receive money for – in case you win the lottery.
4. After completing the forms, you return them to us. On your way back to your seat please check that your number is among the lottery “tickets” on the table up front.
5. The lottery takes place. The person whose number comes up will now have to wait until it is determined by a draw which car the prize relates to: There is a 2/3 chance of getting the car the winner has said he or she prefers, 1/3 chance for the other one. (In case the winner has stated that the cars are equally good, we toss a coin to get the prize car.)
6. Now, we have the prize car! We toss a coin to see whether the winner gets the car or the money he or she has bid on this car. Heads for the car, tails for the money. Thus, if heads, the car is “lost” to the winner and won’t be auctioned off.
7. If tails, there will be an auction on this car. The highest bidder gets the car at a *price equal to that of the second highest bidder*. You should take this into account when stating your bids -- that you never have to pay the price of your bid, only the *lower price equal to that of second highest bid*. In addition, please note that
- i) if the winner, whose prize car is to be auctioned off, also happens to be the highest bidder on this car, he or she simply gets the car for keeps.
  - ii) if there are *two or more persons stating the same highest bid* on a car, lottery will be arranged among them to select a winner; the winner pays the highest price *below* that stated by the winner.
8. The winner pays a down payment of SEK 1,000 and enters an agreement with us, stating when – Tuesday May 30, at the latest -- the purchase will be completed and the car picked up.
9. The remaining car is auctioned off. The bid from the person who got the first car is excluded. The highest bidder among those remaining wins this second car and pays the second highest price. Payment and car delivery as explained in the preceding point.

*PLEASE ... Don't forget to bring enough money on Monday! Look forward to seeing you!*  
 Staffan Stockeld /in charge of the administration of the experiment/  
 ...”

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