

Bosch-Domènech, Antoni; Silvestre, Joaquim

Working Paper

Measuring risk aversion with lists: A new bias

Working Paper, No. 12-10

Provided in Cooperation with:

University of California Davis, Department of Economics

Suggested Citation: Bosch-Domènech, Antoni; Silvestre, Joaquim (2012) : Measuring risk aversion with lists: A new bias, Working Paper, No. 12-10, University of California, Department of Economics, Davis, CA

This Version is available at:

<https://hdl.handle.net/10419/58375>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

UC DAVIS

DEPARTMENT OF ECONOMICS

Working Paper Series

Measuring risk aversion with lists: A new bias

Antoni Bosch-Domènech
Universitat Pompeu Fabra
Joaquim Silvestre

May 20, 2012

Paper # 12-10

Various experimental procedures aimed at measuring individual risk aversion involve a list of pairs of alternative prospects. We first study the widely used method by Holt and Laury (2002), for which we find that the removal of some items from the lists yields a systematic decrease in risk aversion. This bias is quite distinct from other confounds that have been previously observed in the use of the Holt and Laury method. It may be related to empirical phenomena and theoretical developments where better prospects increase risk aversion. Nevertheless, we have also found that the more recent elicitation method due to Abdellaoui et al. (2011), also based on lists, does not display any statistically significant bias when the corresponding items of the list are removed. Our results suggest that methods other than the popular Holt and Laury one may be preferable for the measurement of risk aversion.

Department of Economics
One Shields Avenue
Davis, CA 95616
(530)752-0741

http://www.econ.ucdavis.edu/working_search.cfm

Measuring risk aversion with lists: A new bias
by Antoni Bosch-Domènech, *Universitat Pompeu Fabra*
and Joaquim Silvestre, University of California, Davis

ABSTRACT

Various experimental procedures aimed at measuring individual risk aversion involve a list of pairs of alternative prospects. We first study the widely used method by Holt and Laury (2002), for which we find that the removal of some items from the lists yields a systematic decrease in risk aversion. This bias is quite distinct from other confounds that have been previously observed in the use of the Holt and Laury method. It may be related to empirical phenomena and theoretical developments where better prospects increase risk aversion. Nevertheless, we have also found that the more recent elicitation method due to Abdellaoui et al. (2011), also based on lists, does not display any statistically significant bias when the corresponding items of the list are removed. Our results suggest that methods other than the popular Holt and Laury one may be preferable for the measurement of risk aversion.

KEY WORDS: Risk aversion, risk attitudes, experiments, lists, elicitation method, Holt, Laury, Abdellaoui, Driouchi, l'Haridon, independence axiom.

JEL Classification Number: C 91

A new bias in the use of lists to measure risk aversion

by Antoni Bosch-Domènech, *Universitat Pompeu Fabra*
and Joaquim Silvestre, *University of California, Davis*

1. Introduction

Various experimental procedures aimed at eliciting information on risk attitudes involve a list of pairs of alternative prospects. The present paper investigates the robustness of such procedures with respect to the removal of some pairs from the list.

We first study the widely used method by Holt and Laury (2002) [HL in what follows] and enquire whether the removal of some pairs from their list affects the choices made by experimental subjects. We find that it does so in a systematic way: the removal of better, end-of-list pairs induces subjects to display less risk aversion than when facing the whole list. This invalidates the numerical estimation of the degree of risk aversion of an individual.¹

This systematic bias, together with other findings in the literature with the same flavor, may suggest a more general idea that the inclusion of better prospects in a list of choices favors risk aversion. But it cannot be a universal principle: we conduct similar robustness checks on the elicitation method of Mohammed Abdellaoui *et al.* (2011) [ADH in what follows], also based on lists of pairs of prospects, and find no evidence of such a bias: the frequency of risk averse choices for a given pair of the list is statistically invariant with respect to the deletion of other items.²

2. The Holt & Laury method

2.1. Purpose

HL state (p. 1645) that they “present subjects with a menu of choices that permits measurement of the degree of risk aversion, and also estimation of its functional form.” In order to measure the degree of risk aversion, they first match (Table 3, p. 1649) the subjects’ choices to risk aversion intervals based on the CRRA von Neumann Morgenstern (vNM) utility function $x^{1-r} / (1-r)$ (the variable x is the *ex post* amount of money, and the parameter r is the coefficient of relative risk

¹ With respect to the HL procedure, it has already been noted that the order in which the tasks are implemented may confound the results (Glenn Harrison *et al.* 2005; see also Holt and Laury, 2005). In other experiments, Chetan Dave *et al.* (2010) consider the effect of differing degrees of difficulty. Framing effects are reported in Mark Isaac and Duncan James (2000) and Louis Lévy-Garboua *et al.* (2012). Our robustness test yields a different type of confound.

² Also, our own method (Bosch-Domènech and Silvestre, 1999, 2006a, b, c, 2010) for eliciting risk attitudes based on lists of a different kind does not evidence a statistically significant effect of deletions.

aversion). The last pages of the paper report maximum-likelihood estimates of the parameters r and α of the vNM function $(1 - \exp(-\alpha x^{1-r})) / \alpha$, first proposed by Atanu Saha (1993).

2.2. Description of the Holt and Laury method

Subjects in HL face a list of *ten* pairs of binary lotteries, which we can number from one to ten as in Table 1 below, each pair involving a “safe” lottery (S) and a “risky” one (R). The terms “safe” and “risky,” used by HL, must be understood in a loose sense and relative to each other: in a given pair, lottery R gives a larger good payoff, but a lower bad payoff, than S .³

All S lotteries offer the same payoffs, namely \$2 and \$1.60, but with varying probabilities. An S lottery with a high lottery-pair number first-order stochastically dominates any S lottery with a lower number, since it gives the larger payoff (\$2) with higher probability. The list of R lotteries displays exactly the same feature. Hence, a lottery pair with a higher number offers an unambiguously better prospect than one with a lower number.

Of course, first-order stochastic dominance implies higher expected value. The last three columns in Table 1 (not shown to the experimental subjects) indicate the expected dollar values of the safe lottery in the pair (denoted EV^S) and that of the risky lottery (denoted EV^R), as well as the difference between the two. A risk-neutral individual would choose the pattern $SSSS/RRRRR$. Thus, a subject who chooses $SSSS/RRRRR$ displays risk aversion.

2.3. Our experimental design: Changing list length in Holt and Laury

We designed five treatments, numbered 1 to 5, and carried them out in six sessions, labeled A to F . Our Treatment 1 is the control treatment, where subjects face the complete list of Table 1, with euro payoffs obtained by multiplying by three the dollar amounts of Table 1. These payoffs were maintained in all treatments.

In treatments 2 to 5 we ran the experiment with lists of *seven* (lottery) pairs where some of the better pairs and/or some of the worse pairs of Table 1 (three in total) have been eliminated.

Specifically, in Treatment 2, each subject faced the seven-pair list obtained by deleting the first three rows of Table 1. In Treatment 3, each subject faced the seven-pair list obtained by

³ The two lotteries entail the same probabilities for the good and bad payoffs, and their expected values are different, i. e., R is not a mean-preserving spread of S . In lottery pair 10 the good outcome is certain in both R and S : hence, R is not risky at all.

deleting rows 1, 2 and 10 of Table 1. In Treatment 4, each subject faced the seven-pair list obtained by deleting rows 1, 9 and 10 of Table 1. Finally, in Treatment 5 each subject faced the seven-pair list described in Table 2 and obtained by deleting the last three rows from Table 1. We were particularly interested in the decisions for pairs 4 to 7, which are present in all five treatments.

| Lottery Pair # | Safe Lottery (<i>S</i>) | | | | Risky Lottery (<i>R</i>) | | | | EV^S | EV^R | Difference |
|-------------------|---------------------------|--------|-------|--------|----------------------------|--------|-------|--------|--------|--------|------------|
| | Prob. | Payoff | Prob. | Payoff | Prob. | Payoff | Prob. | Payoff | | | |
| 1 | 0.1 | \$2 | 0.9 | \$1.60 | 0.1 | \$3.85 | 0.9 | \$0.10 | \$1.64 | \$0.48 | \$1.17 |
| 2 | 0.2 | \$2 | 0.8 | \$1.60 | 0.2 | \$3.85 | 0.8 | \$0.10 | \$1.68 | \$0.85 | \$0.83 |
| 3 | 0.3 | \$2 | 0.7 | \$1.60 | 0.3 | \$3.85 | 0.7 | \$0.10 | \$1.72 | \$1.23 | \$0.49 |
| 4 | 0.4 | \$2 | 0.6 | \$1.60 | 0.4 | \$3.85 | 0.6 | \$0.10 | \$1.76 | \$1.60 | \$0.16 |
| 5 | 0.5 | \$2 | 0.5 | \$1.60 | 0.5 | \$3.85 | 0.5 | \$0.10 | \$1.80 | \$1.98 | -\$0.17 |
| 6 | 0.6 | \$2 | 0.4 | \$1.60 | 0.6 | \$3.85 | 0.4 | \$0.10 | \$1.84 | \$2.35 | -\$0.51 |
| 7 | 0.7 | \$2 | 0.3 | \$1.60 | 0.7 | \$3.85 | 0.3 | \$0.10 | \$1.88 | \$2.73 | -\$0.84 |
| 8 | 0.8 | \$2 | 0.2 | \$1.60 | 0.8 | \$3.85 | 0.2 | \$0.10 | \$1.92 | \$3.10 | -\$1.18 |
| 9 | 0.9 | \$2 | 0.1 | \$1.60 | 0.9 | \$3.85 | 0.1 | \$0.10 | \$1.96 | \$3.48 | -\$1.52 |
| 10 | 1 | \$2 | 0 | \$1.60 | 1 | \$3.85 | 0 | \$0.10 | \$2.00 | \$3.85 | -\$1.85 |

Table 1. Design of the Holt and Laury experiments (adapted from Harrison *et al.*, 2005).

| Lottery Pair # | Safe Lottery (<i>S</i>) | | | | Risky Lottery (<i>R</i>) | | | | EV^S | EV^R | Difference |
|----------------------|---------------------------|----------------|----------------|-------------------|----------------------------|-------------------|----------------|-------------------|-------------------|-------------------|--------------------|
| | Prob. | Payoff | Prob. | Payoff | Prob. | Payoff | Prob. | Payoff | | | |
| 1 | 0.1 | \$2 | 0.9 | \$1.60 | 0.1 | \$3.85 | 0.9 | \$0.10 | \$1.64 | \$0.48 | \$1.17 |
| 2 | 0.2 | \$2 | 0.8 | \$1.60 | 0.2 | \$3.85 | 0.8 | \$0.10 | \$1.68 | \$0.85 | \$0.83 |
| 3 | 0.3 | \$2 | 0.7 | \$1.60 | 0.3 | \$3.85 | 0.7 | \$0.10 | \$1.72 | \$1.23 | \$0.49 |
| 4 | 0.4 | \$2 | 0.6 | \$1.60 | 0.4 | \$3.85 | 0.6 | \$0.10 | \$1.76 | \$1.60 | \$0.16 |
| 5 | 0.5 | \$2 | 0.5 | \$1.60 | 0.5 | \$3.85 | 0.5 | \$0.10 | \$1.80 | \$1.98 | -\$0.17 |
| 6 | 0.6 | \$2 | 0.4 | \$1.60 | 0.6 | \$3.85 | 0.4 | \$0.10 | \$1.84 | \$2.35 | -\$0.51 |
| 7 | 0.7 | \$2 | 0.3 | \$1.60 | 0.7 | \$3.85 | 0.3 | \$0.10 | \$1.88 | \$2.73 | -\$0.84 |
| 8 | 0.8 | \$2 | 0.2 | \$1.60 | 0.8 | \$3.85 | 0.2 | \$0.10 | \$1.92 | \$3.10 | -\$1.18 |
| 9 | 0.9 | \$2 | 0.1 | \$1.60 | 0.9 | \$3.85 | 0.1 | \$0.10 | \$1.96 | \$3.48 | -\$1.52 |
| 10 | 1 | \$2 | 0 | \$1.60 | 1 | \$3.85 | 0 | \$0.10 | \$2.00 | \$3.85 | -\$1.85 |

Table 2. The deletion of the last three rows of Table 1.

Subjects in the experiment were students from the *Universitat Pompeu Fabra* who volunteered. Because of concern for order effects, we scrambled the order of our treatments and repeated one of them as a “return to baseline.” For instance, Treatment 1 preceded Treatment 5 three times while followed it four times. In each session, we ran four different treatments in the following orders.

Session *A*, with 28 subjects, implemented treatments 5, 3, 2, 1, 5.

Session *B*, with 24 subjects, treatments 2, 4, 5, 1, 2.

Session *C* with 21 subjects, treatments 1, 5, 3, 2, 1.

Session *D*, with 24 subjects, treatments 3, 5, 2, 1, 3.

Session *E*, with 22 subjects, treatments 4, 1, 2, 3, 4.

And Session *F*, with 26 subjects, treatments 1, 4, 2, 5, 4.

2.4. Including better (end-of-list) pairs favors risk aversion

Tables A1 to A6 in the Appendix present the raw experimental data for sessions *A* to *F*. We can visualize the overall outcomes in Table 3, which displays the rate of safe choices per pair and treatment aggregated over Sessions *A* to *F*.

Formally, and ignoring for the moment the last two columns, the entry in Table 3 for Pair j ($j = 1, \dots, 10$) and Treatment i ($i = 1, \dots, 5$) is the quotient:

$$\frac{\text{Number of } S \text{ choices in Pair } j \text{ and Treatment } i \text{ aggregated over Sessions } A-F}{\text{Number of choices (} S \text{ and } R \text{) in Pair } j \text{ and Treatment } i \text{ aggregated over Sessions } A-F}$$

We have marked in boldface the pairs common to all five treatments, namely pairs 4 to 7. Figure 1 plots the frequency of safe choices for treatments 1, 2 and 5. Recall that Treatment 1, our control, covers the ten pairs of Table 1 and Treatment 2 deletes the first three pairs, whereas Treatment 5 deletes the last three, as shown in Table 2.

By comparing the first two columns of Table 3 (Treatment 2 vs. control), we observe that the deletion of the first three (worse) pairs slightly increases the rate of safe choices. Treatment 5, which deletes the three last (best) pairs, shows a marked decrease in the rate of safe choices. See Figure 1, where the gap between the graphs for treatments 1 and 2 is dwarfed by the one between treatments 1 and 5. It appears that, as good pairs (bottom of list) are replaced by bad ones (top of list), risk aversion becomes less frequent.

Next, we focus on the individual decisions by each participant as he or she confronts two different treatments in the same session, and ask whether each participant made or not the same choice in the two treatments, testing whether any observed asymmetries could be due to chance. To that effect, we use the McNemar test and obtain significant p -values (0.007 for pair 6, and 0.001 for pair 7) when comparing treatments 1 and 5, even after applying the Bonferroni correction. On the other hand, the p -values were not significant when comparing treatments 1 and 2. In summary, within-subjects analysis confirms the observation that when participants decide on a particular pair, a higher frequency of risk-averse behavior is observed when that pair is embedded in a set that includes good (end of list) pairs.

In addition, Section 4.1 below presents the results of Fischer's exact tests, showing that the observed differences for pairs 6 and 7 between our control Treatment 1 and Treatment 5, as well as the differences between control and Treatment 4 for pair 7, are statistically significant. Note that treatments 4 and 5 delete the largest numbers of good (end of list) pairs.

As we repeatedly noted, good pairs appear at the end of the list. Is the observed effect of deleting good pairs due to their goodness or to their position at the end of the list? We address the issue in the following section.

| | Treatment 1 (Control) | Treatment 2 | Treatment 3 | Treatment 4 | Treatment 5 | Average Treat's 2-5 | Max Rate Diff. Treat's 2-5 |
|---------------------------|--------------------------|----------------|----------------|----------------|----------------|---------------------------|-------------------------------------|
| Pair 1 | 0.99 | - | - | - | 0.99 | - | - |
| Pair 2 | 0.99 | - | - | 0.99 | 0.98 | - | - |
| Pair 3 | 0.99 | - | 0.96 | 1.00 | 0.98 | - | - |
| Pair 4 | 0.97 | 0.99 | 0.94 | 0.99 | 0.97 | 0.97 | 0.05 |
| Pair 5 | 0.89 | 0.91 | 0.86 | 0.87 | 0.80 | 0.86 | 0.14 |
| Pair 6 | 0.71 | 0.76 | 0.69 | 0.63 | 0.58 | 0.66 | 0.28 |
| Pair 7 | 0.34 | 0.36 | 0.30 | 0.19 | 0.18 | 0.26 | 1.00 |
| Pair 8 | 0.11 | 0.11 | 0.05 | 0.06 | - | - | - |
| Pair 9 | 0.03 | 0.01 | 0.01 | - | - | - | - |
| Pair 10 | 0.00 | 0.01 | - | - | - | - | - |
| Number of observations | 144 | 120 | 94 | 72 | 122 | | |

Table 3. Rate of safe choices per pair and treatment, Holt and Laury method (in bold the pairs common to all treatments).

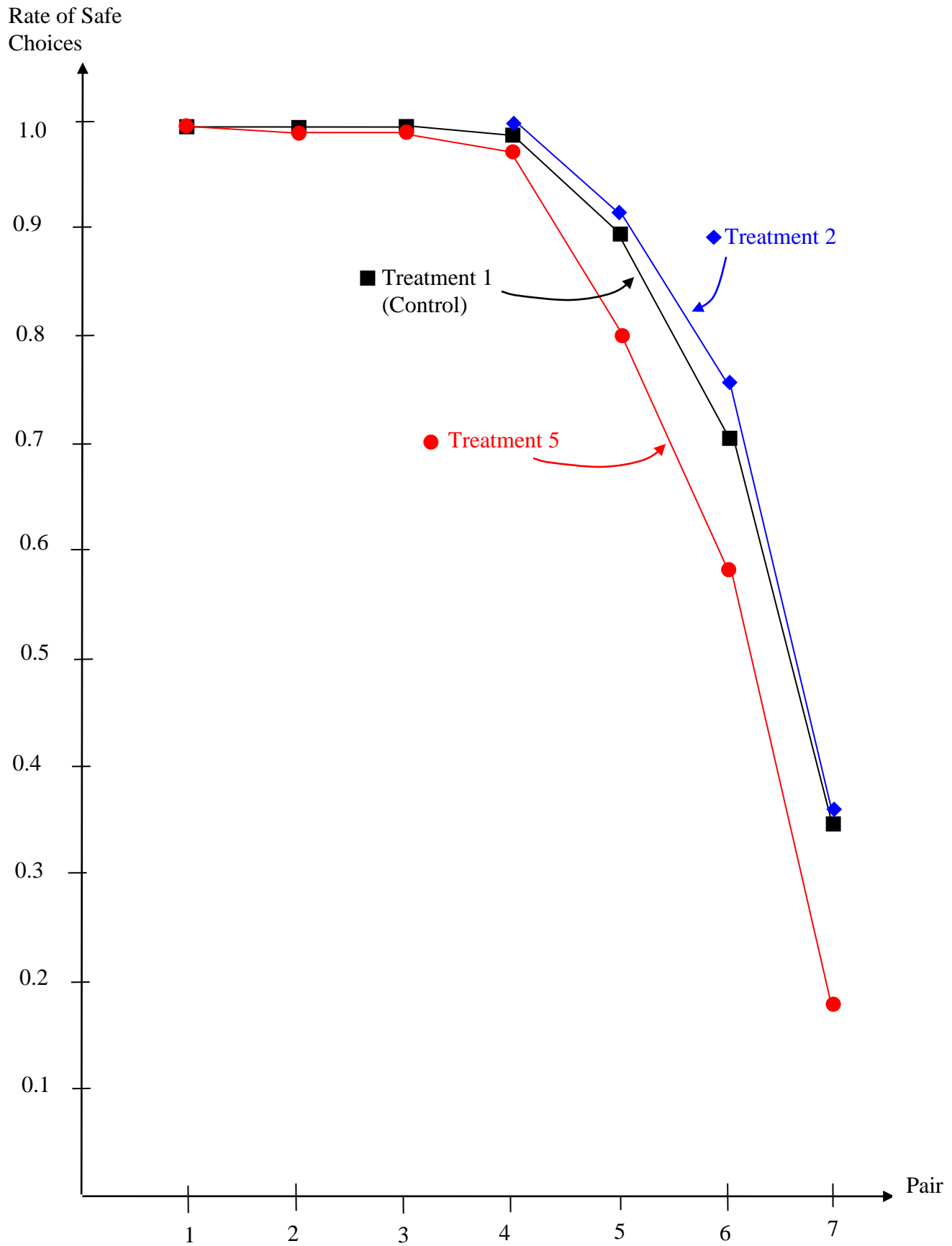


Figure 1. The rate of safe choices in treatments 1, 2 and 5 for pairs 1 to 7, Holt and Laury method.

2.5. The irrelevance of the position in the list: Inverting the order of the pairs

The tendency, in some of the shorter lists, to switch earlier from the safe to the risky option brings to mind the phenomenon discussed in Steffen Andersen *et al.* (2006) that, in multiple-price lists, subjects may be inclined to pick a response in the middle of the list, independent of true valuations. An inspection of the results in Table 3 shows that such an attraction for the middle does not appear in our experiment: the middle pair in a list of seven is the fourth one, and the fraction of subjects who choose the safe lottery there goes from 0.36 in Treatment 2 to 0.97 in Treatment 5.

But, as indicated above, the increase in risk aversion as good pairs are removed could conceivably be due to an “end-of-list” effect, since the good pairs are located at the end. One simple way of exploring the issue consists in running the experiment with the order of the pairs inverted, i. e., giving the subjects a list that begins with the *better* pairs and ends with the *worse* pairs. If, in the inverted treatments, we observe again that risk aversion is less frequent when removing the better pairs, now located at the beginning of the list, then we will be more confident that it is not the distance to the end of the list that drives the effect.

Accordingly, we have run sessions *A* to *F* with the inverted order of pairs. The aggregate results are shown in Table 4. One observation is clear from the table, namely that the previously observed effect survives the inversion of the order of lotteries. Moreover, as before, it is more noticeable in pairs 6 and 7. Therefore, we must conclude that the position of the pairs in the list is not what drives the observed bias.

| | Treatment 1i (Control) | Treatment 2i | Treatment 3i | Treatment 4i | Treatment 5i | Average Treat's 2i to 5i | Max Rate Diff. Treat's 2i to 5i |
|---------------------------|---------------------------|-----------------|-----------------|-----------------|-----------------|--------------------------------|---------------------------------------|
| Pair 1 | 0.99 | - | - | - | 0.99 | | - |
| Pair 2 | 0.98 | - | - | 0.98 | 0.99 | | - |
| Pair 3 | 0.98 | - | 0.97 | 0.98 | 0.99 | | - |
| Pair 4 | 0.98 | 0.96 | 0.97 | 0.98 | 0.93 | 0.96 | 0.05 |
| Pair 5 | 0.85 | 0.87 | 0.83 | 0.86 | 0.78 | 0.83 | 0.12 |
| Pair 6 | 0.67 | 0.72 | 0.67 | 0.58 | 0.49 | 0.61 | 0.47 |
| Pair 7 | 0.31 | 0.36 | 0.34 | 0.23 | 0.16 | 0.27 | 1.25 |
| Pair 8 | 0.12 | 0.10 | 0.05 | 0.07 | - | - | - |
| Pair 9 | 0.01 | 0.02 | 0.01 | - | - | - | - |
| Pair 10 | 0.00 | 0.00 | - | - | - | - | - |
| Number of Observations | | 171 | 165 | 124 | 108 | 124 | |

Table 4. Inverted treatments: Rate of safe choices per pair and treatment in the Holt and Laury method (in bold the pairs common to all treatments). To facilitate the comparison with Table 3, we keep the same ordering of the pairs in both tables. However, one should keep in mind that, in the inverted treatments of Table 4, the order of the lotteries was inverted, so that subjects faced listings of pairs beginning with Pair 10, and ending with Pair 1.

3. The Abdellaoui *et al.* method

3.1. Our experimental design: Changing list length in Abdellaoui *et al.*

We adapt the ADH method by adding one row to their Table 3 in order to facilitate the comparison with the HL procedure. The adapted list appears as our Table 5.⁴ In both the HL and ADH procedures, subjects face a list of “safe” and “risky” pairs, but in ADH the safe alternative is a sure payoff that increases along the list, while the risky one is a 50-50 fixed lottery, that we implement by a coin toss.

⁴ Here too the column displaying the expected values was not shown to the experimental subjects.

| Pair | Option A (Safe) | Option B (Risky) | Expected payoff diff. |
|------|--------------------|---------------------------|--------------------------|
| 1 | €5.00 | €15 if heads, €5 if tails | -5.00 |
| 2 | €6.10 | €15 if heads, €5 if tails | -3.90 |
| 3 | €7.20 | €15 if heads, €5 if tails | -2.80 |
| 4 | €8.30 | €15 if heads, €5 if tails | -1.70 |
| 5 | €9.45 | €15 if heads, €5 if tails | -0.55 |
| 6 | €10.55 | €15 if heads, €5 if tails | 0.55 |
| 7 | €11.70 | €15 if heads, €5 if tails | 1.70 |
| 8 | €12.80 | €15 if heads, €5 if tails | 2.80 |
| 9 | €13.90 | €15 if heads, €5 if tails | 3.90 |
| 10 | €15.00 | €15 if heads, €5 if tails | 5.00 |

Table 5. Our adaptation of the Abdellaoui *et al.* design; payoffs in euros.

We designed five treatments, numbered 1 to 5, and carried them out in five sessions, labeled *A* to *E*. As in our experiment on the HL method, our Treatment 1 is the control treatment, where subjects face the complete list of Table 5.

In treatments 2 to 5 we ran the experiment with lists of seven pairs where some of the better pairs and/or some of the worse pairs of Table 5 (three in total) have been eliminated.

In Treatment 2, each subject faced the seven-pair list obtained by deleting the first three rows of Table 5. In Treatment 3, each subject faced the seven-pair list obtained by deleting rows 1, 2 and 10 of Table 5. In Treatment 4, each subject faced the seven-pair list obtained by deleting rows 1, 9 and 10 of Table 5. Finally, in Treatment 5 each subject faced the seven-pair list obtained by deleting the last three rows from Table 1. We were particularly interested in the decisions for pairs 4 to 7, which are present in all five treatments.

Once more, subjects were students from the *Universitat Pompeu Fabra*. Because of concern for order effects, we scrambled the order of our treatments and repeated one of them as a “return to baseline.” In each session, we ran four different treatments in the following orders.

Session *A*, with 21 subjects, implemented treatments 1, 5, 3, 4, 1.

Session *B*, with 21 subjects, treatments 2, 1, 4, 5, 2.

Session *C* with 20 subjects, treatments 3, 2, 5, 1, 3.

Session *D*, with 21 subjects, treatments 4, 3, 1, 2, 4.

And Session *E*, with 21 subjects, treatments 5, 4, 2, 3, 5.

3.2. Results

Tables A13 to A17 in the Appendix present the raw experimental data for sessions *A* to *E*. We can visualize the overall outcomes in Table 6, which displays the rate of safe choices per pair and treatment aggregated over sessions *A* to *E*: the format is that of tables 3 and 4 above.

| | Treatment 1 (Control) | Treatment 2 | Treatment 3 | Treatment 4 | Treatment 5 | Average Treat's 2-5 | Max Rate Diff. Treat's 2-5 |
|---------------------------|--------------------------|----------------|----------------|----------------|----------------|---------------------------|-------------------------------------|
| Pair 1 | 0.00 | - | - | - | 0.00 | - | - |
| Pair 2 | 0.00 | - | - | 0.00 | 0.00 | - | - |
| Pair 3 | 0.08 | - | 0.07 | 0.06 | 0.09 | - | - |
| Pair 4 | 0.29 | 0.24 | 0.23 | 0.29 | 0.37 | 0.28 | 0.51 |
| Pair 5 | 0.73 | 0.66 | 0.71 | 0.75 | 0.72 | 0.71 | 0.14 |
| Pair 6 | 0.93 | 0.91 | 0.94 | 0.94 | 0.96 | 0.94 | 0.05 |
| Pair 7 | 1.00 | 0.98 | 0.98 | 0.97 | 0.97 | 0.98 | 0.03 |
| Pair 8 | 1.00 | 1.00 | 0.99 | 1.00 | - | - | - |
| Pair 9 | 1.00 | 1.00 | 1.00 | - | - | - | - |
| Pair 10 | 1.00 | 1.00 | - | - | - | - | - |
| Number of observations | 83 | 83 | 83 | 84 | 83 | | |

Table 6. Rate of safe choices per pair and treatment for the Abdellaoui *et al.* method (in bold, the pairs common to all treatments)

The inspection of Table 6 shows that the pairs more affected by the deletions are pairs 4 and 5. By comparing the first two columns of Table 6 (Treatment 2 vs. control), we observe that the deletion of the first three (worse) pairs slightly *decreases* the rate of safe choices. Treatment 5, which deletes the three last (best) pairs, shows no consistent pattern of differences from control. In any event, as we will see in Section 4.1 below, Fischer's exact test indicates that the differences are not statistically significant.

4. Discussion

4.1. Comparing Holt and Laury with Abdellaoui *et al.*

The main lesson of our experiments is that the HL and ADH methods respond quite differently to the deletions of pairs. We have performed Fischer's exact test for both methods, focusing on pairs 6 and 7 in HL, and pairs 4 and 5 in ADH, the pairs that show larger responses to the deletions. The results are displayed in Table 7.

| | Holt and Laury method | | Abdellaoui <i>et al.</i> method | |
|--------------------------------|-----------------------|---------------|---------------------------------|--------|
| | Pair 6 | Pair 7 | Pair 4 | Pair 5 |
| Treatment 1 vs. Treatment 2 | 0.40 | 0.79 | 0.43 | 0.36 |
| Treatment 1 vs. Treatment 3 | 0.88 | 0.57 | 0.27 | 0.76 |
| Treatment 1 vs. Treatment 4 | 0.28 | 0.039 | 1.00 | 0.75 |
| Treatment 1 vs. Treatment 5 | 0.039 | 0.0035 | 0.30 | 1.00 |

Table 7. Double-tail Fischer's exact test p -values. Significant results in bold.

We observe that the differences between treatments and control are not significant for the ADH method. But in the case of the HL method, and confirming our observations in Section 2.4 above, we obtain significant differences for Treatment 4 and Pair 7, and for Treatment 5 and pairs 6 and 7. Recall that in Treatment 4 (resp. 5) we delete the two (resp. three) best pairs.

The inspection of the last two columns of tables 3, 4 and 6 provides an informal confirmation of the asymmetry. Averaging over The treatments 2 to 5 yields numbers that are relatively close to control in ADH, whereas they are markedly different for pairs 6 and 7 in HL. And the maximal-rate differences for treatments 2 to 5 are typically larger in HL than in ADH, indicating more dispersion.

While our results evidence a clear asymmetry between the two methods, the reasons for this asymmetry are not clear to us.

4.2. Increasing risk aversion and violations of the independence axiom

Our result that, in HL, the deletion of better pairs favors an earlier switch to the riskier option shows that the choice in a given pair is not independent from the list where it is placed. Hence, a subject displaying such behavior cannot be maximizing preferences that satisfy the independence axiom and, therefore, the expected utility hypothesis (see, e. g., Andreu Mas-Colell *et al.*, 1995). Therefore, any formalization of this behavior must discard the independence axiom. It follows from our experimental results that HL repeated reliance on vNM utility functions is not well grounded, despite the awareness previously evidenced by Holt (1986).

Mark Machina (1982, 1983) tackled the more common observed violations of the independence axiom by proposing a *generalized expected utility model* characterized by the smoothness of the utility function U defined on the space of probability distributions, so that a *local vNM-type utility function* can be defined at each probability distribution. He showed that the most common violations of the independence axiom (the effects named common consequence, common ratio, oversensitivity to changes in small probability outlying events, and utility evaluation) were implied by an elegant condition, which he called Hypothesis II, by which the local vNM-type utility function of a “better” probability distribution is more concave (implying more risk aversion) than the one corresponding to a worse probability distribution.⁵ Hence, under Hypothesis II the decision maker displays a higher degree of risk aversion in the neighborhood of a better probability distribution than in the neighborhood of a worse one.

The result that the deletion of better pairs in the HL method favors risk taking is in line with Machina’s analysis: each lottery (S or R) in pairs that appear in Treatment 1 but not in Treatment 5 (namely 8, 9 and 10) first-order statistically dominates the corresponding lottery (S or R) in all pairs in Treatment 5: in this sense, Treatment 1 offers better pairs than Treatment 5. The fact that the subjects in our test of the HL method display more risk aversion in Treatment 1 than in Treatment 5 parallels Machina’s observation.

4.3. The effects of the inclusion of better options on choice

Our result on the HL method that the inclusion of better pairs favors an later switch to the riskier lottery displays an interesting similarity with a finding by Ian Bateman, Brett Day, Graham

⁵ Machina (1982, 1983) uses “better” in the precise sense of first order stochastic dominance. Geometrically, Hypothesis II implies that the indifference curves “fan out” in the Marschak-Machina triangle.

Loomes and Robert Sugden (2007) in the process of analyzing the preference reversal phenomenon. They observe that the certainty equivalent of a given lottery (say, Lottery I or Lottery J in their Table 1) is lower when included in a list of better lotteries (Set 1 *ibid.*) than when included in a set of worse lotteries (Set 2 *ibid.*). Because a higher certainty equivalent corresponds to a lower degree of risk aversion, their observation implicitly points towards the phenomenon that including better choices in a list favors risk aversion.⁶

4.4. Does risk taking increase when removing pairs where the risky option is more popular?

As noted, the ADH method does not show a statistically significant dependence of the frequency of safe choices on the deletions. Yet some deviations from control do occur, particularly in Treatment 2, in which the rate of safe choices is smaller than in control. Now, in Treatment 2, it is the *worse* choice pairs that have been deleted: this goes in the opposite direction to the bias displayed by HL, where it is the deletion of the *better* prospects that decreases risk aversion.

Notice, however, that in HL most subjects, when confronted with the *better* pairs, choose the risky option, whereas in ADH most subjects choose the risky alternative in the *worse* pairs. Perhaps, then, what drives the changes in risk aversion is the deletion of pairs where most subjects choose the risky alternative, rather than the deletion of better or worse pairs.

Table 8 offers a comparative summary of the features associated with decreased risk aversion in the HL and ADH methods.

⁶ The literature offers instances of the more general dependence of the value, or category, assigned to a particular item on the set of items in which it is embedded. In the medical literature, Angela Robinson, Michael Jones-Lee and Graham Loomes (2001) observe how respondents' rankings of descriptions of road injuries depend on the set of descriptions in which there are included. In psychology, Allen Parducci and Douglas Weddell (1986) define a "range-frequency effect" where the category assigned to the size of a square (e. g., large, or small) depends both on the number of allowable categories and on the support and the frequency of the distribution of sizes in the list presented to the subject. Neil Stewart, Gordon Brown and Nick Chater (2005) ascertain the importance of the intensity difference between a stimulus and the previous one in the sequence. In marketing research, Joel Huber, John Payne and Christopher Puto (1982) study consumers' choices when confronted with a set of products each of which is favored in a different dimension (size, quality, color, price), and observe that introducing a new product that is dominated in all dimensions by one of the existing products results in the latter product being hugely favored by consumers. This is an instance of how asymmetric dominance may affect choices, as analyzed by Wilfred Amaldoss *et al.* (2008).

| | | |
|------------------------------------|---|---|
| Holt and Laury Method | Removal of good pairs = Removal of pairs where most subjects choose the risky option | → fewer safe choices = less risk aversion (statistically significant) |
| Abdellaoui <i>et al.</i> Method | Removal of bad pairs = Removal of pairs where most subjects choose the risky option | → fewer safe choices = less risk aversion (not statistically significant) |

Table 8. Comparison of the features associated with decreased risk aversion

We have pondered three explanations for the phenomenon of decreased risk aversion clearly observed in the HL method, namely the deletion of (a) better pairs, (b) end of list pairs, and (c) pairs where the risky option is more popular. Our analysis in Section 2.4 above definitely rules (b) out. If we attached any importance to the statistically not significant changes observed in our test of the ADH method, then we would have to rule (a) out, leaving only (c). But at this point, in the absence of further research, it would be reckless to bet on this explanation.

5. Conclusions

The paper tests the robustness of experimental procedures, aimed at measuring risk aversion, where subjects face a list of pairs of alternative prospects. More specifically, we examine whether the removal of some items of the list affects the outcomes, focusing on the widely used Holt and Laury (2002) method and on the more recent one by Abdellaoui *et al.* (2011). Either method uses a list of pairs: we conduct experiments where some pairs are removed from the list. We ask: are decisions on a particular pair influenced by the presence or absence of other pairs in the list?

We experimentally discover a systematic bias in the Holt and Laury method: as some specific pairs are removed, risk aversion becomes less frequent. No statistically significant bias appears, on the contrary, in our test of the Abdellaoui *et al.* method.

The pairs whose deletion induces the reduction of risk aversion in the Holt and Laury method are the better pairs, and also the last ones in the list. By repeating our experiment with the order of pairs inverted, we find that the position of the pairs in the list is irrelevant.

But it would be premature to explain the phenomenon in terms of the removal of *good* pairs: even though the results for our test of Abdellaoui *et al.* are not statistically significant, they point away from this explanation.

In conclusion, our experimental results provide a new call for caution when using the Holt and Laury method to estimate individual risk aversion, and suggest that better alternatives can be found.

APPENDIX

| Treatment 5 | Treatment 3 | Treatment 2 | Treatment 1 | Treatment 5 |
|--------------|---------------|---------------|---------------|--------------|
| SSSSSS/R000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSS/RRRR | SSSSS/RR000 |
| SSSSSSS000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSS/RRR | SSSSSSS000 |
| SSSSS/RR000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSSS/RRR | SSSSSS/R000 |
| SSSSSS/R000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSSS/RRR | SSSSSS/R000 |
| SSSSSSS000 | 00SSSSSS/R0 | 000SSSSSS/R | SSSSSSSSS/R | SSS/RR/SS000 |
| SSSSS/RR000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSSS/RRR | SSSSSS/R000 |
| SSSSSSS000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSS/RRR | SSSSS/RR000 |
| SSSSS/RR000 | 00SSS/RRRR0 | 000SS/RRRRR | SSSSS/RRRRR | SSSS/RRR000 |
| SSSSSS/R000 | 00SSSS/RRR0 | 000SSSSS/RR | SSSSSSS/RRR | SSSSSS/R000 |
| SSSSSS/R000 | 00SSSS/RRR0 | 000SSSSS/RR | SSSSSSS/RRR | SSSSSS/R000 |
| SSSSSSS000 | 00SSSSS/RR0 | 000SSSSS/RR | SSSS/RRRRRR | S/RRRRRR000 |
| SSSSSS/R000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR | SSSSSS/R000 |
| SSSSSS/R000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSSSS/RR | SSSSSSS000 |
| SSSSS/RR000 | 00SSSS/RRR0 | 000S/R/SS/RRR | SSSSSSSSS/RR | SSSSS/RR000 |
| SSSS/RRR000 | 00SS/RRRRR0 | 000S/RRRRRR | SSSSS/RRRRR | SSSS/RRR000 |
| SSSS/RRR000 | 00SS/RRRRR0 | 000S/RRRRRR | SSSSS/RRRRR | SSSSS/RR000 |
| SSSSS/R/S000 | 00S/RR/SS/RR0 | 000SSS/RRR/S | SSSSSS/R/S/RR | S/RR/SSSS000 |
| SSSSSS/R000 | 00SSSSSS/R0 | 000SSSS/RRR | SSSSSS/RRRR | SSSSS/RR000 |
| SSSSSS/R000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR | SSSSSS/R000 |
| SSSSSS/R000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSSSS/RR | SSSSSSS000 |
| SSSS/RRR000 | 00SS/RRRRR0 | 000SSS/RRRR | SSSSS/RRRRR | SSSS/RRR000 |
| SSSSSS/R000 | 00SSS/RRRR0 | 000SSS/RRRR | SSSSS/RRRRR | SSSSSS/R000 |
| SSSSSS/R000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSS/RRRR | SSSSSSS000 |
| SSSSS/RR000 | 00SSSS/RRR0 | 000SS/RRRRR | SSSSS/RRRRR | SSSSS/RR000 |
| SSSSS/RR000 | 00SSS/RRRR0 | 000SS/RRRRR | SSSS/RRRRR | SSSSS/RR000 |
| SSSS/RRR000 | 00SS/RRRRR0 | 000S/RRRRRR | SSSS/RRRRR | SSSSSSS000 |
| SSS/RRRR000 | 00SSS/RRRR0 | 000S/RRRRRR | SSSSS/RRRRR | SSSSSSS000 |
| SSSSS/RR000 | 00SSSSS/RR0 | 000SSS/RRRR | SSSSSS/RRRR | SSSSSS/R000 |

Table A1. Choices of subjects (28) in Session A for the Holt and Laury method (here and in the following tables zeroes mark the deletion of pairs).

| Treatment 2 | Treatment 4 | Treatment 5 | Treatment 1 | Treatment 2 |
|---------------|---------------|---------------|---------------|-------------|
| 000SSS/RRRR | 0SSSS/RRR00 | SSSSS/RR000 | SSSS/RRRRRR | 000SS/RRRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SSS/RRRR | 0SSSS/RRR00 | SSSSS/RR000 | SSSSS/RRRRR | 000SSS/RRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SSS/RRRR | 0SSSS/RRR00 | SSSSS/RR000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SSSSS/RR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSSS/RRR | 000SSSSS/RR |
| 000SS/RRRRR | 0SSSS/RRR00 | SSS/RRRR000 | SSSS/RRRRRR | 000S/RRRRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSS/RRRRR | 000SSS/RRRR |
| 000S/RRRRRR | 0SSS/RRRR00 | SSSS/RRR000 | SSSSSS/RRRR | 000S/RRRRRR |
| 000SS/RRRRR | 0SSSS/RRR00 | SSSSS/RR000 | SSSSS/RRRRR | 000SS/RRRRR |
| 000SS/RRRRR | 0SSS/RRRR00 | SSSSS/RR000 | SSSSS/RRRRR | 000SSS/RRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SS/R/S/RRR | 0SSSS/RRR00 | SS/R/S/RRR000 | SSSSS/RRRRR | 000SSS/RRRR |
| 000SSS/RRR/S | 0SSS/RRR/S00 | SSS/RRR/S000 | SSSSSSSSSS | 000RRR/SSSS |
| 000SSSS/RRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSSS/RRR | 000SSSS/RRR |
| 000SSSS/RRR | 0SSSSS/RR00 | SSSSSSS000 | SSSSSSS/RRR | 000SSSS/RRR |
| 000S/RRRRRR | 0SSS/RR/S/R00 | SS/R/S/RRR000 | SSS/RRR/S/RRR | 000SSS/RRRR |
| 000SSSS/RRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSSS/RRR | 000SSSS/RRR |
| 000SS/RRRRR | 0SSSS/RRR00 | SSSSSS/R000 | SSSSS/RRRRR | 000SS/RRRRR |
| 000SS/RRRRR | 0SSSS/RRR00 | SSSSS/RR000 | SSSSSS/RRRR | 000SS/RRRRR |

Table A2. Choices of subjects (24) in Session *B* for the Holt and Laury method.

| Treatment 1 | Treatment 5 | Treatment 3 | Treatment 2 | Treatment 1 |
|---------------|-------------|-------------|-------------|-------------|
| SSSSSS/RRR | SSSSS/RR000 | 00SSSS/RR0 | 000SSSS/RRR | SSSSSS/RRRR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSSS/RR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSS/RRRR | SSSSS/RR000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSS/RRR | SSSSSSS000 | 00SSSS/RR0 | 000SSSS/RRR | SSSSSS/RRR |
| SSSSSS/RRRR | SSSSSSS000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSS/RRRR0 | 000SS/RRRRR | SSSSSS/RRRR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSSSS/RR | SSSSSSSS/RR |
| SSSSSSS/RRR | SSSSSS/R000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSS/RRR |
| SSSSSS/RRRR | SSSSS/RR000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSS/RRRRR | SSSSS/RR000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSS/RRRRR |
| SSSSSSSS/RR | SSSSSS/R000 | 00SSSSS/RR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSSS/RRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSSS/RRR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSSS/RRR |
| SSSSS/RRRRR | SSSSS/RR000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSS/RRRR |
| SSSSSSS/RRR | SSSSS/RR000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSSS/RRR |
| SS/R/SS/RRRRR | SSSS/RRR000 | 00SSS/RRRR0 | 000SSSS/RRR | SSSSSS/RRRR |
| SSSSSS/RRRR | SSSS/RRR000 | 00SSS/RRRR0 | 000SS/RRRRR | SSSSSS/RRRR |
| SSSSSSS/RRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSSS/RRR |
| SSSS/RRRRRR | SSSSSSS000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSSS/RRR |

Table A3. Choices of subjects (21) in Session C for the Holt and Laury method.

| Treatment 3 | Treatment 5 | Treatment 2 | Treatment 1 | Treatment 3 |
|----------------|---------------|---------------|----------------|---------------|
| 00SSS/RRRR0 | SSSS/RRR000 | 000SSS/RRRR | SSSSS/RRRRR | 00SSS/RRRR0 |
| 00SSS/RRRR0 | SSSS/RRR000 | 000SS/RRRRR | SSSS/RRRRRR | 00SS/RRRRR0 |
| 00SSS/RRRR0 | SSSSS/RR000 | 000SSS/RRRR | SSSSSS/RRRR | 00SSSSS/RRR0 |
| 00SSSSS/RR0 | SSSSSSS000 | 000SSSS/RRR | SSSSSSS/RRR | 00SSSSS/RR0 |
| 00SS/RRRRR0 | SSS/RRRR000 | 000RRRRRRR | SSS/R/S/RRRRR | 00SS/RRRRR0 |
| 00SSS/RRRR0 | SSSSS/RR000 | 000SSS/RRRR | SSSS/RRRRRR | 00SSS/RRRR0 |
| 00SSSSS/RRR0 | SSSSS/RR000 | 000SSS/RRRR | SSSSSS/RRRR | 00SSSSS/RRR0 |
| 00SSS/RRRR0 | SSSS/RRR000 | 000S/RRRRRR | SSSSSS/RRRR | 00SSSSS/RRR0 |
| 00SSS/RRRR0 | SSSS/RRR000 | 000SS/RRRRR | SSSSS/RRRRR | 00SSS/RRRR0 |
| 00SS/RRRRR0 | SSSS/RRR000 | 000SS/RRRRR | SSSSS/RRRRR | 00SS/RRRRR0 |
| 00SSSSS/RR0 | SSSSSSS/R000 | 000SSSS/RRR | SSSSSSS/RRR | 00SSSSS/RR0 |
| 00SSSSS/RR0 | SSSSSSS/R000 | 000SSS/RRRR | SSSSSSS/RRRR | 00SSSSS/RRR0 |
| 00SSSSS/RR0 | RR/S/R/SSS000 | 000RR/S/R/SSS | RR/S/R/SSSS/RR | 00RR/S/R/SSS0 |
| 00SS/R/S/RRR0 | SSSSSSS000 | 000SSSSS/RR | SSSSSSS/RRR | 00SSSSS/RR0 |
| 00SSSSS/RR0 | SSSSSSS/R000 | 000SSS/RRRR | SSSSSSS/RRR | 00SSSSS/RR0 |
| 00SSSSS/RR0 | SSSSSSS000 | 000SSSS/RRR | SSSSSSS/RRR | 00SSSSS/RR0 |
| 00SS/RRRRR0 | SSS/RRRR000 | 000RRRRRRR | SSSSS/RRRRR | 00SSS/RRRR0 |
| 00SSSSS/RR0 | SSSSSSS/R000 | 000SSS/RRRR | SSSSSSS/RRRR | 00SSSSS/RRR0 |
| 00SSSSS/R/S/R0 | SSSSS/RR000 | 000SSS/RRRR | SSSSSSSS/RR | 00SSSSS/RR0 |
| 00RRRRRRR0 | SSSSSSS/R000 | 000SSS/RRRR | SSSSSSS/RRRR | 00SSSSS/RRR0 |
| 00RRRRRRR0 | SSSS/RRR000 | 000RRRRRRR | SSSS/RRRRRR | 00SS/RRRRR0 |
| 00SSSSS/RR0 | SSSS/RRR000 | 000SSSS/RRR | SSSSSSS/RRR | 00SSSSS/RR0 |
| 00SS/RRRRR0 | SSSS/RRR000 | 000SSS/RRRR | SSSS/RRRRRR | 00SSS/RRRR0 |
| 00SSSSSSS0 | SSSSSSS000 | 000SSSSSS/R | SSSSSSSSS/R | 00SSSSSSS0 |

Table A4. Choices of subjects (24) in Session *D* for the Holt and Laury method.

| Treatment 4 | Treatment 1 | Treatment 2 | Treatment 3 | Treatment 4 |
|-------------|-------------|-------------|-------------|-------------|
| 0SSSSS/RR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSSS/RSR00 | SSSSSSS/RRR | 000SSSS/RRR | 00SSSSS/RR0 | 0SSSSS/RR00 |
| 0SS/RRRRR00 | SSS/RRRRRRR | 000RRRRRRR | 00S/RRRRRR0 | 0SS/RRRRR00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSS/RSRR00 | SSSSS/RRRRR | 000SSSSS/RR | 00SSSSS/RR0 | 0SSSSS/RR00 |
| 0SSSSSS/R00 | SSSSSSSS/RR | 000SSSSS/RR | 00SSSSSS/R0 | 0SSSSSS/R00 |
| 0SSSS/RRR00 | SSSSSS/RRRR | 000SSSS/RRR | 00SSSS/RRR0 | 0SSSS/RRR00 |
| 0SSSS/RRR00 | SSSS/RRRRRR | 000SS/RRRRR | 00SSS/RRRR0 | 0SSSS/RRR00 |
| 0SSS/RRRR00 | SSSSS/RRRRR | 000SSS/RRRR | 00SSS/RRRR0 | 0SSSS/RRR00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSS/RRR00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSS/RRRR00 | SSSS/RSRRRR | 000S/RRRRRR | 00RRRRRRR0 | 0SSS/RRRR00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSSSS/RR00 | SSSSSSS/RRR | 000SSSS/RRR | 00SSSSS/RR0 | 0SSSSS/RR00 |
| 0RSRRRRR00 | SSRSRRSRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSS/RRRR00 | SSSSSSS/RRR | 000SSS/RRRR | 00SSSSS/RR0 | 0SSSSSS/R00 |
| 0SSS/RRRR00 | SSSSS/RRRRR | 000SS/RRRRR | 00SSSSS/RR0 | 0SSSS/RRR00 |
| 0SSSS/RRR00 | SSSSS/RRRRR | 000SS/RRRRR | 00SSS/RRRR0 | 0SSSSS/RR00 |
| 0SSSS/RRR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSSSS/RS00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSSS/R00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSSS/RR0 | 0SSSSSS/R00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 000SS/RRRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |

Table A5. Choices of subjects (22) in Session *E* for the Holt and Laury method.

| Treatment 1 | Treatment 4 | Treatment 2 | Treatment 5 | Treatment 4 |
|-------------|-------------|-------------|-------------|-------------|
| SSSSSSS/RR | 0SSSSS/R00 | 000SSSS/RRR | SSSSSSS000 | 0SSSSS/R00 |
| SSSSSS/RRRR | 0SSS/RRRR00 | 000SSS/RRRR | SSSS/RRR000 | 0SSS/RRRR00 |
| SSSSSS/RRRR | 0SSSSS/RR00 | 000SSS/RRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSS/RRRR | 0SSSSS/RR00 | 000SSS/RRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSS/RRRR | 0SSSSS/R00 | 000SSSS/RRR | SSSSSSS000 | 0SSSSS/R00 |
| SSSSSSS/RRR | 0SSSSS/RR00 | 000SS/RRRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSS/RRRRR | 0SSSSS/RR00 | 000SSS/RRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSS/RRRR | 0SSSS/RRR00 | 000SS/RRRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSSS/RRR | 0SSSSSS/R00 | 000SSSS/RRR | SSSSSS/R000 | 0SSSSSS/R00 |
| SSSSS/RRRRR | 0SSSS/RRR00 | 000SS/RRRRR | SSSSS/RR000 | 0SSSS/RRR00 |
| SSS/RRRRRRR | 0SSS/RRRR00 | 000S/RRRRRR | SSSS/RRR000 | 0SSS/RRRR00 |
| SSSSSSS/RRR | 0SSSSSS/R00 | 000SSSS/RRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSSS/RRR | 0SSSSSS/R00 | 000SSSS/RRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSS/RRRR | 0SSSSS/RR00 | 000SSS/RRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSSS/RRR | 0SSSSS/RR00 | 000SSS/RRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSSSS/RR | 0SSSSSS/R00 | 000SSSSS/RR | SSSSSSS000 | 0SSSSSSS00 |
| SSSSS/RRRRR | 0SSSS/RRR00 | 000SS/RRRRR | SSSSS/RR000 | 0SSSSS/RR00 |
| SSSSSS/RRRR | 0SSSS/RRR00 | 000SSS/RRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSS/RRRR | 0SSSS/RRR00 | 000SS/RRRRR | SSSSS/RR000 | 0SSSS/RRR00 |
| SSSSSS/RRRR | 0SSSSS/RR00 | 000SSS/RRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSRSSRRR | 0SSSSSS/R00 | 000SSSSS/RR | SSSSSSS000 | 0SSSSSSS00 |
| SSSSSS/RRRR | 0SSSS/RRR00 | 000SSS/RRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSSSSS/R | 0SSSSSSS00 | 000SSSSSS/R | SSSSSSS000 | 0SSSSSSS00 |
| SSSSSSSS/RR | 0SSSSSS/R00 | 000SSSSS/RR | SSSSSSS000 | 0SSSSSSS00 |
| SSSSSSSS/RR | 0SSSSSS/R00 | 000SSSSS/RR | SSSSSSS000 | 0SSSSSSS00 |
| SSSSS/RRRRR | 0SSSS/RRR00 | 000SSS/RRRR | SSSSSS/R000 | 0SSSSS/R00 |

Table A6. Choices of subjects (26) in Session *F* for the Holt and Laury method.

| Treatment 5 | Treatment 3 | Treatment 2 | Treatment 1 | Treatment 5 |
|-------------|-------------|-------------|-------------|-------------|
| SSSRSSR000 | 00SSRRRS0 | 000SSS/RRRR | SSSSRSRRRS | SSRSRSR000 |
| SSS/RRRR000 | 00S/RRRRRR0 | 000RRRRRRR | SSS/RRRRRRR | SSS/RRRR000 |
| SSRSRRR000 | 00RRRSRSS0 | 000SRRSRS | RRRSSSSRRR | SSSS/RRR000 |
| SSSSS/RR000 | 00SSS/RRRR0 | 000SS/RRRRR | SSSSSRRRRR | SSSSS/RR000 |
| SRSSRSS000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSSRRR | SSSSSSS000 |
| SSSSS/RR000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSSSRRR | SSSSSSS000 |
| SSSSSS/R000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSSRRRR | SSSSSS/R000 |
| SSSSS/RR000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSSRRRR | SSSSSS/R000 |
| SSSS/RRR000 | 00SS/RRRRR0 | 000S/RRRRRR | SSSSRRRRRR | SSSS/RRR000 |
| SSSSS/RR000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSSRRRR | SSSSSR000 |
| SSSS/RRR000 | 00SSS/RRRR0 | 000SS/RRRRR | SSSSSRRRRR | SSSSS/RR000 |
| SSSSSS/R000 | 00SSSSS/RR0 | 000SSSSS/RR | SSSSSSSRR | SSSSSSS000 |
| SSSSS/RR000 | 00SSSS/RRR0 | 000S/RRRRRR | SSSSSRRRRR | SSSSSS/000 |

Table A7.

Choices of subjects (13) in Session A_i (= *A* with order inverted) for the Holt and Laury method.

| Treatment 2 | Treatment 4 | Treatment 5 | Treatment 1 | Treatment 2 |
|-------------|-------------|-------------|-------------|-------------|
| 000SSS/RRRR | 0SSSSS/RR00 | SSSS/RRR000 | SSSSS/RRRRR | 000SSS/RRRR |
| 000SSSSS/RR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSSSS/RR |
| 000RSRSSSR | 0RRSRSSS00 | RRRSRSS000 | RRRRRSSSSS | 000RSSSSSSS |
| 000SSS/RRRR | 0SSSS/RRR00 | SSSSS/RR000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SRRSRRR | 0SSS/RRRR00 | SSSS/RRR000 | SSSS/RRRRRR | 000S/RRRRRR |
| 000SSS/RRRR | 0SSS/RRR00 | SSS/RRRR000 | SSSS/RRRRRR | 000S/RRRRRR |
| 000SS/RRRRR | 0SSSS/RRR00 | SSSSS/RR000 | SSSSS/RRRRR | 000SS/RRRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSS/RR000 | SSSSS/RRRRR | 000SS/RRRRR |
| 000SSSS/RRR | 0SSSSSS/R00 | SSSSSS/R000 | SSSSSSS/RRR | 000SSSSS/RR |
| 000RRRRRRR | 0SSRRRS00 | SSS/RRR000 | SSRRRRRSRS | 000RRRRRSR |
| 000SSSS/RRR | 0SSSSSSS00 | SSSSSSS000 | SSSSSSS/RRR | 000SSSS/RRR |
| 000SSSS/RRR | 0SSSSS/RR00 | SSSS/RRR000 | SSSSSSS/RRR | 000SSS/RRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SSSS/RRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSRSRRRR | 000SSSS/RRR |
| 000SSSSS/RR | 0SSSSSSS00 | SSSSSS/R000 | SSSSSSSSS/R | 000SSSSSS/R |
| 000SSSSS/RR | 0SSSSSS/R00 | SSSSSS/R000 | SSSSSSS/RRR | 000SSS/RRRR |
| 000SS/RRRRR | 0SSSS/RRR00 | SSSSS/RR000 | SSSSS/RRRRR | 000SS/RRRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SSSSSS/R | 0SSSSSSS00 | SSSSSSS000 | SSSSSSSSS/R | 000SSSSSS/R |
| 000SRRRRRR | 0SSS/RRRR00 | SSS/RRR000 | SSRRRRRSRS | 000SSRRRSR |
| 000SSSS/RRR | 0SSSS/RRR00 | SSSSS/RR000 | SSSSS/RRRRR | 000SS/RRRRR |
| 000SSS/RRRR | 0SSSS/RRR00 | SSSSS/RR000 | SSSSS/RRRRR | 000SS/RRRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSSS/RRR | 000SSSS/RRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSSS/RRR | 000SSSS/RRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSS/RR000 | SSSSSS/RRRR | 000SSS/RRRR |
| 000SSS/RRRR | 0SSSSS/RR00 | SSSSSS/R000 | SSSSSS/RRRR | 000SSS/RRRR |

Table A8.

Choices of subjects (26) in Session Bi ($= B$ with order inverted) for the Holt and Laury method.

| Treatment 1 | Treatment 5 | Treatment 3 | Treatment 2 | Treatment 1 |
|---------------|--------------|-------------|-------------|-------------|
| S/RRRRRRRR | SSSS/RRR000 | 00SSS/RRRR0 | 000S/RRRRRR | SSSSS/RRRRR |
| SSSSS/RRRRR | SSSS/RRR000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSS/RRRRR |
| SSSSSS/RRRR | SSSS/RRR000 | 00SSS/RRRR0 | 000SS/RRRRR | SSSSS/RRRRR |
| SSSSSSS/RRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSS/RRRR |
| SSSSSSSS/RR | SSSSSSS000 | 00SSSSSS/R0 | 000SSSSS/RR | SSSSSSSS/RR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSS/RRRR |
| SSSSSSS/RRR | SSSSSS/R000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSS/RRRR |
| SSSSSSSS/RR | SSSSSSS000 | 00SSSSS/RR0 | 000SSSSS/RR | SSSSSSSS/RR |
| SSSSSSS/RRR | SSSSS/RR000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSS/RRRR | SSSSS/RR000 | 00SSS/RRRR0 | 000SS/RRRRR | SSSSSSS/RRR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSSS/RRR | SSSSSSS000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSS/RRR |
| SSSSSSSS/RR | SSSSSSS000 | 00SSSSSS/R0 | 000SSSSS/RR | SSSSSSSS/RR |
| RRRRRRRRRR | SSSSS/RR000 | 00SSS/RRRR0 | 000SSS/RRRR | SSSSS/RRRRR |
| SSSSS/RRRRR | SSSSSS/R000 | 00SSSS/RRR0 | 000SSSS/RRR | SSSSSS/RRRR |
| SS/R/S/RRRRRR | SSSSS/RR000 | 00SSS/RRRR0 | 000RRRRRRR | SSSSS/RRRRR |
| SSSSS/RRRRR | SSSSS/RR000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSSS/RRR | SSSSSSS000 | 00SSSSS/RR0 | 000SSS/RRRR | SSSSSSS/RRR |
| SSSS/RRRRRR | SSSS/RRR000 | 00SS/RRRRR0 | 000S/RRRRRR | SSSS/RRRRRR |
| SSSSSSS/RRR | SSSSS/RR000 | 00SSSS/RRR0 | 000SS/RRRRR | SSSSSS/RRRR |
| SSSSSSSS/RR | SSSSSS/R000 | 00SSSSS/RR0 | 000SS/RRRR | SSSSSS/RRRR |
| SSSSSSSS/RR | SSSSSSS000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSSS/RR |
| SSSSSS/RRRR | SSSSSS/R000 | 00SSSSSS/R0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSS/RRRR/S | SSSS/RRR000 | 00SS/RRRRR0 | 000S/RRRRRR | SSSS/RRRRRR |
| SSSSSSSS/RR | SSSSSS/R000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSSS/RR |
| SSSS/RRRRRR | SSSS/RRR000 | 00SS/RRRRR0 | 000S/RRRRRR | SSSS/RRRRRR |
| SSSS/RRRRRR | SSSSS/RR000 | 00SSSS/RRR0 | 000SSS/RRRR | SSSSSS/RRRR |
| SSSSSSS/RRR | SSSSSSS000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSS/RRR |
| SSSS/RRRRRR | SSSS/RRR000 | 00SS/RRRRR0 | 000S/RRRRRR | SSSS/RRRRRR |
| SSSSS/RRRRR | SSSSS/RR000 | 00SSS/RRRR0 | 000SS/RRRRR | SSSSS/RRRRR |
| SSSSSSSS/RR | SSSSSS/RR000 | 00SSSSSSS0 | 000SSSSS/RR | SSSSSSSS/RR |
| SSSSS/RRRRR | SSSSS/RR000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSS/RRR |
| SSSSS/RRRRR | SSSSSS/R000 | 00SSSSS/RR0 | 000SSSS/RRR | SSSSSSS/RRR |

Table A9.

Choices of subjects (35) in Session C_i ($= C$ with order inverted) for the Holt and Laury method.

| Treatment 3 | Treatment 5 | Treatment 2 | Treatment 1 | Treatment 3 |
|---------------|---------------|----------------|--------------|--------------|
| 00SSSS/RRR0 | SSSS/RRR000 | 000SS/RRRRR | SSSSS/RRRRR | 00SSS/RRRR0 |
| 00SSSS/RRRR0 | SSSSS/RR000 | 000SSS/RRRR | SSSSS/RRRRR | 00SSS/RRRR0 |
| 00SSSS/RRR0 | SSSS/R/S/R000 | 000SS/RRRRR | SSS/RRRRRRR | 00 SSS/RRRR0 |
| 00SSS/R/SS/R0 | SSSSSS/R000 | 000SSSS/RRR | SSSSSS/RRRR | 00SSSS/RRR0 |
| 00SSS/RRRR0 | SSSSS/RR000 | 000SS/RRRRR | SSSS/RRRRRR | 00SS/RRRRR0 |
| 00SS/R/S/RRR0 | SSSS/R/S/R000 | 000SSS/RRRR | SSSSSS/RRRR | 00SSSS/RRR0 |
| 00SSSS/RRR0 | SSSSS/RR000 | 000SSS/RRRR | SSSSSS/RRRR | 00SSSS/RRR0 |
| 00SSSS/RRR0 | SSSSSS/R000 | 000SSSS/RRR | SSSSSSS/RRR | 00SSSS/RRR0 |
| 00RRRRRRR0 | SSSSSSS000 | 000SS/RRRRR | SSSS/RRRRRRR | 00SS/RRRRR0 |
| 00SSSS/RRR0 | SSSSSS/R000 | 000SSS/RRRR | SSSSSS/RRRR | 00SSSS/RRR0 |
| 00SSSSS/RR0 | SSSSSS/R000 | 000SSSS/RRR | SSSSSSS/RRR | 00SSSSS/RR0 |
| 00SSSS/RRR0 | SSSSS/RR000 | 000 SSS/RRRR | SSSSSS/RRRR | 00SSSS/RRR0 |
| 00RRRRRRR0 | SSSS/RRR000 | 000S/RRRRRR | SSSS/RRRRRRR | 00SS/RRRRR0 |
| 00SSSS/RRR0 | SSSSSS/R000 | 000SSS/RRRR | SSSSSS/RRRR | 00SSSS/RRR0 |
| 00SSSS/RRR0 | SSSSSS/R000 | 000SSS/RRRR | SSSSSSS/RRR | 00SSSSS/RR0 |
| 00SS/RRRRR0 | SSSS/RRR000 | 000S/RRRRRR | SSSS/RRRRRRR | 00SS/RRRRR0 |
| 00SSSS/RRR0 | SSSSS/RR000 | 000SSS/RRRR | SSSSSS/RRRR | 00SSSS/RRR0 |
| 00SSS/RRRR0 | SSS/R/S/RR000 | 000S/RRRRRR | SSSS/RRRRRRR | 00SS/RRRRR0 |
| 00SSSSS/RR0 | SSSSSSS000 | 000SSSS/RRR | SSSSSSS/RRR | 00SSSSS/RR0 |
| 00SSSSS/RR0 | SSSSSS/R000 | 000SSSS/RRR | SSSSSS/RRRR | 00SSSSS/RR0 |
| 00SSSS/RRR0 | SSSSSS/R000 | 000SSSS/RRR | SSSSSS/RRRR | 00SSSSS/RR0 |
| 00SSSSS/RR0 | R/SSS/RR/S000 | 000SS/R/S/RR/S | SSSSSS/RRRR | 00SSSSS/RR0 |
| 00SSSSS/RR0 | SSS/RRRR000 | 000S/RRRRRR | SSSS/RRRRRRR | 00SS/RRRRR0 |
| 00SSSS/RRR0 | SSSSS/RR000 | 000SSSS/RRR | SSSSSS/RRRR | 00SS/RRRRR |

Table A10.

Choices of subjects (24) in Session Di ($= D$ with order inverted) for the Holt and Laury method.

| Treatment 4 | Treatment 1 | Treatment 2 | Treatment 3 | Treatment 4 |
|----------------|------------------|----------------|-----------------|------------------|
| 0SSSSS/RR00 | SSSSSS/RRRR | 00SSSS/RRR | 00SSSS/RR0 | 0SSSSS/R00 |
| 0SSSS/RRR00 | SSSSSSSS/RR | 00SSSSS/RR | 00SSSSSS/R0 | 0SSSSSSS00 |
| 0SSSSSSS00 | SSSSSSSS/RR | 00SSSSS/RR | 00SSSSSS/R0 | 0SSSSSS/R00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 00SSSS/RRR | 00SSSSS/RR0 | 0SSSSS/RR00 |
| 0SSSS/RRR00 | SSSSS/RRRRR | 00SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSSS/RRR00 | SSSSSS/RRRR | 00SSSS/RRR | 00SSSSS/RR0 | 0SSSSSS/R00 |
| 0SSS/RRRR00 | SSSSS/RRRRR | 000S/RRRRR | 00SSS/RRR00 | 0SSSS/RRR00 |
| 0SS/RR/SS/R00 | R/S/R/SSS/R/S/RR | 000R/SS/R/SS/R | 00S/R/S/R/S/RR0 | 0S/R/S/R/S/R/S00 |
| 0SSSSSS/R00 | SSSSSS/RRRR | 000SSSS/RRR | 00SSSSS/RR0 | 0SSSSSS/R00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSSS/RRR00 | SSSSS/RRRRR | 000SS/RRRRR | 00SSS/RRRR0 | 0SSSS/RRR00 |
| 0SSSS/RRR00 | SSSSS/RRRRR | 000SSS/RRRR | 00SS/RRRRR0 | 0SSSS/RRR00 |
| 0SSSS/RRR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSSS/RRR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSSS/RRR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |
| 0SSSSS/RR00 | SSSSSSS/RRR | 000SSSS/RRR | 00SSSSS/RR0 | 0SSSSSS/R00 |
| 0SSSSS/RR00 | SSSSSSS/RRR | 000SSSS/RRR | 00SSSSS/RR0 | 0SSSSSS/R00 |
| 0SSSSSSS/R00 | SSSSSSS/RRR | 000SSSS/RRR | 00SSSSS/RR0 | 0SSSSSS/R00 |
| 0SSS/RRRR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSS/RRRR0 | 0SSSS/RRR00 |
| 0SSSS/RRR00 | SSSSS/RRRRR | 000RRRRRRR | 00SSS/RRRR0 | 0SSS/RRRR00 |
| 0RRRRRRR00 | RRRRRRRRRR | 000RRRRRRR | 00RRRRRRR0 | 0RRRRRRR00 |
| 0SSSSS/RR00 | SSSSS/RRRRR | 000SS/RRRRR | 00SSS/RRRR0 | 0SSSS/RRR00 |
| 0SSSS/RRR00 | SSSSS/RRRRR | 000SSS/RRRR | 00SS/RRRRR0 | 0SSS/RRRR00 |
| 0S/R/A/RRR/A00 | SSSS/R/S/RR/S/R | 000SSS/R/S/RR | 00SS/RRR/SS0 | 0SS/RR/S/RR00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 000R/SS/RRRR | 00SS/RRRRR0 | 0SSSS/RRR00 |
| 0SSSSSSS00 | SSSSSS/RRRR | 000SSSS/RRR | 00SSSSS/RR0 | 0SSSSSS/R00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 000SSSS/RRR | 00SSSSS/RR0 | 0SSSSSS/R00 |
| 0SSSSS/RR00 | SSSSSS/RRRR | 000SSS/RRRR | 00SSSS/RRR0 | 0SSSSS/RR00 |

Table A11.

Choices of subjects (28) in Session Ei ($= E$ with order inverted) for the Holt and Laury method.

| Treatment 1 | Treatment 4 | Treatment 2 | Treatment 5 | Treatment 4 |
|-------------|--------------|-------------|-------------|--------------|
| SSSSSS/RRRR | 0SSSSS/RR00 | 000SSSS/RRR | SSSSSSS000 | 0SSSSSS/R00 |
| SSSSS/RRRRR | 0SSS/RRRR00 | 000SSS/RRRR | SSSSS/RR000 | 0SSSSS/RR00 |
| SSSSS/RRRRR | 0SSSS/RRR00 | 000SSS/RRRR | SSSS/RRR000 | 0SSSS/RRR00 |
| SSSSSS/RRRR | 0SSSSS/RR00 | 000SSS/RRRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSS/RRRR | 0SSSS/RRR00 | 000SS/RRRRR | SSSSS/RR000 | 0SSSS/RRR000 |
| SSSS/RRRRRR | 0SSS/RRRR00 | 000SS/RRRRR | SSSSSS/R000 | 0SSSS/RRR00 |
| SSSSSSS/RRR | 0SSSSSS/R00 | 000SSSS/RRR | SSSSSSS000 | 0SSSSSS/R00 |
| SSSSSSS/RRR | 0SSSSSS/R00 | 000SSSS/RRR | SSSSSSS000 | 0SSSSSS/R00 |
| SSSSSS/RRRR | 0SSSS/RRR00 | 000SS/RRRRR | SSSSS/RR000 | 0SSSS/RRR00 |
| SSSSSSSS/RR | 0SSSSS/RR00 | 000SSSS/RRR | SSSSSS/R000 | 0SSSSS/RR00 |
| SSSSSS/RRRR | 0SSSS/RRR00 | 000SSS/RRRR | SSSS/RRR000 | 0SSSS/RRR00 |
| SSSS/RRRRRR | 0SSS/RRRR00 | 000SSS/RRRR | SSSSS/RR000 | 0SSSSS/RR00 |
| SSSSSS/RRRR | 0SS/RR/SSS00 | 000SS/RRRRR | SSSSSSS000 | 0SSSSS/RR00 |

Table A12.

Choices of subjects (13) in Session Fi ($= F$ with order inverted) for the Holt and Laury method.

| Treatment 1 | Treatment 5 | Treatment 3 | Treatment 4 | Treatment 1 |
|---------------|-------------|-------------|--------------|-------------|
| RR/S/RR/SSSSS | RRRR/SSS000 | 00RRR/SSSS0 | 0RR/SSSSS00 | RRR/SSSSSSS |
| RRRR/SSSSSS | RRRR/SSS000 | 00RR/SSSSS0 | 0RRR/SSSS00 | RRRR/SSSSSS |
| RRR/SSSSSSS | RRR/SSSS000 | 00R/SSSSSS0 | 0RR/SSSSS00 | RRR/SSSSSSS |
| RRR/SSSSSSS | RRR/SSSS000 | 00RR/SSSSS0 | 0RR/SSSSS00 | RRR/SSSSSSS |
| S/RRRR/SSSSS | RRRRR/SS000 | 00RRR/SSSS0 | 0RRRR/SSS00 | RRRRR/SSSSS |
| RRR/SSSSSSS | RRR/SSSS000 | 00RR/SSSSS0 | 0RR/SSSSS00 | RRRR/SSSSSS |
| RRRR/SSSSSS | RRRR/SSS000 | 00RR/SSSSS0 | 0RRR/SSSS00 | RRRR/SSSSSS |
| RRRRR/SSSSS | RRRRR/SS000 | 00RR/SSSSS0 | 0RRRR/SSS00 | RRRRR/SSSSS |
| RR/SSSSSSSS | RR/SSSSS000 | 00SSSSSSS0 | 0R/SSSSSSS00 | RR/SSSSSSSS |
| RRRR/SSSSSS | RRRR/SSS000 | 00RR/SSSSS0 | 0RRR/SSSS00 | RRRR/SSSSSS |
| RRRR/SSSSSS | RRRR/SSS000 | 00RR/SSSSS0 | 0RRR/SSSS00 | RRRR/SSSSSS |
| RRRR/SSSSSS | RRRR/SSS000 | 00RR/SSSSS0 | 0RRR/SSSS00 | RRRR/SSSSSS |
| RRRR/SSSSSS | RRRR/SSS000 | 00RR/SSSSS0 | 0RRR/SSSS00 | RRRR/SSSSSS |
| RRRRR/SSSSS | RRRRR/SS000 | 00RRR/SSSS0 | 0RRRR/SSS00 | RRRRR/SSSSS |
| RRRR/SSSSSS | RRRR/SSS000 | 00RR/SSSSS0 | 0RRR/SSSS00 | RRRR/SSSSSS |
| RRRRR/SSSSS | RRRRR/SS000 | 00RRR/SSSS0 | 0RRRR/SSS00 | RRRRR/SSSSS |
| RRRRRR/SSSS | RRRRRR/S000 | 00RRRRR/SS0 | 0RRRRRR/S00 | RRRRRR/SSSS |
| RRR/SSSSSSS | RRR/SSSS000 | 00RR/SSSSS0 | 0RR/SSSSS00 | RRR/SSSSSSS |
| RRR/SSSSSSS | RRRR/SSS000 | 00RR/SSSSS0 | 0RR/SSSSS00 | RRR/SSSSSSS |
| RRRRR/SSSSS | RRRRR/SS000 | 00RRR/SSSS0 | 0RRRR/SSS00 | RRRRR/SSSSS |
| RRRR/SSSSSS | RRRR/SSS000 | 00RRR/SSSS0 | 0RRRR/SSS00 | RRRRR/SSSSS |

Table A13.

Choices of subjects (21) in Session A for the Abdellaoui *et al.* method.

| Treatment 2 | Treatment 1 | Treatment 4 | Treatment 5 | Treatment 2 |
|-------------|-------------|-------------|-------------|-------------|
| 000SSSSSS | RR/SSSSSS | 0RR/SSSS00 | RRR/SSSS000 | 000SSSSSS |
| 000RR/SSSS | RRRRR/SSSS | 0RRRR/SS00 | RRRRR/SS000 | 000RR/SSSS |
| 000RR/SSSS | RRRR/SSSS | 0RRR/SS00 | RRRR/SS000 | 000R/SSSS |
| 000RR/SSSS | RRRRR/SSSS | 0RRRR/SS00 | RRRRR/SS000 | 000RR/SSSS |
| 000RR/SSSS | RRRRRR/SSSS | 0RRRRR/S00 | RRRRRR/000 | 000RRRR/SSS |
| 000RR/SSSS | RRRR/SSSS | 0RRR/SS00 | RRRR/SS000 | 000R/SSSS |
| 000R/SSSS | RRRR/SSSS | 0RRR/SS00 | RRR/SS000 | 000R/SSSS |
| 000R/SSSS | RRRR/SSSS | 0RRR/SS00 | RRR/SS000 | 000SSSSSS |
| 000SSSSSS | RR/SSSSSS | 0R/SSSS00 | RR/SSSS000 | 000SSSSSS |
| 000RR/SSSS | RRRRR/SSSS | 0RRRR/SS00 | RRRRR/SS000 | 000RR/SSSS |
| 000RR/SSSS | RRRRR/SSSS | 0RRR/SS00 | RRRRR/SS000 | 000RR/SSSS |
| 000RR/SSSS | RRRR/SSSS | 0RRR/SS00 | RRRR/SS000 | 000R/SSSS |
| 000RR/SSSS | RRRRR/SSSS | 0RRRR/SS00 | RRRRR/SS000 | 000RR/SSSS |
| 000R/SSSS | RRRR/SSSS | 0RRR/SS00 | RRRR/SS000 | 000R/SSSS |
| 000R/SSSS | RRR/SSSS | 0RRR/SS00 | RRR/SS000 | 000R/SSSS |
| 000SSSSSS | RRR/SSSS | 0RR/SS00 | RRR/SS000 | 000SSSSSS |
| 000RRR/SSS | RRRRR/SSSS | 0RRRR/SS00 | RRRRR/SS000 | 000RR/SSSS |
| 000RRR/SSS | RRRRRR/SSSS | 0RRRRR/S00 | RRRRRR/000 | 000RRRR/SSS |
| 000SS/RRRR | SSSS/RRRR | 0RRR/SS00 | RRRRR/SS000 | 000R/SSSS |
| 000RR/SSSS | RRR/SSSS | 0RR/SS00 | RRR/SS000 | 000SSSSSS |
| 000SSSSSS | RR/SSSSSS | 0R/SSSS00 | RR/SSSS000 | 000SSSSSS |

Table A14. Choices of subjects (21) in Session *B* for the Abdellaoui *et al.* method.

| Treatment 3 | Treatment 2 | Treatment 5 | Treatment 1 | Treatment 3 |
|--------------|-------------|-------------|-------------|--------------|
| 00R/SSSSSS0 | 000R/SSSSSS | RRR/SSSS000 | RRR/SSSSSSS | 00RR/SSSSSS0 |
| 00RRR/SSSS0 | 000SSSSSSS | RRRRR/SS000 | RRRR/SSSSSS | 00RR/SSSSSS0 |
| 00RR/SSSSSS0 | 000R/SSSSSS | RRR/SSSS000 | RRR/SSSSSSS | 00RR/SSSSSS0 |
| 00RR/SSSSSS0 | 000SSSSSSS | RRR/SSSS000 | RRR/SSSSSSS | 00R/SSSSSSS0 |
| 00R/SSSSSSS0 | 000R/SSSSSS | RR/SSSSS000 | RR/SSSSSSSS | 00SSSSSSS0 |
| 00RR/SSSSSS0 | 000RR/SSSSS | RRRR/SSS000 | RRRR/SSSSSS | 00RR/SSSSSS0 |
| 00SSSSSSSS0 | 000SSSSSSS | RRR/SSSS000 | RRR/SSSSSSS | 00R/SSSSSSS0 |
| 000RRRRRR/S | 000RRR/SSSS | RRRRRRR000 | RRRRRR/SSSS | 00RRRR/SSS0 |
| 00SSSSSSSS0 | 000SSSSSSS | RR/SSSSS000 | RR/SSSSSSSS | 00SSSSSSS0 |
| 00RR/SSSSSS0 | 000R/SSSSSS | RRRR/SSS000 | RRRR/SSSSSS | 00RR/SSSSSS0 |
| 00RRR/SSSS0 | 000R/SSSSSS | RRR/SSSS000 | RRRR/SSSSSS | 00R/SSSSSSS0 |
| 00RRR/SSSS0 | 000RR/SSSSS | RRRRR/SS000 | RRRRR/SSSSS | 00RRR/SSSS0 |
| 00RR/SSSSSS0 | 000R/SSSSSS | RRRR/SSS000 | RRRR/SSSSSS | 00RR/SSSSSS0 |
| 00RRR/SSSS0 | 000RR/SSSSS | RRRR/SSS000 | RRRR/SSSSSS | 00RR/SSSSSS0 |
| 00RR/SSSSSS0 | 000SSSSSSS | RRR/SSSS000 | RRR/SSSSSSS | 00R/SSSSSSS0 |
| 00RR/SSSSSS0 | 000R/SSSSSS | RRR/SSSS000 | RRRR/SSSSSS | 00RRR/SSSS0 |
| 00RRR/SSSS0 | 000RR/SSSSS | RRRR/SSS000 | RRRRR/SSSSS | 00RRRR/SSS0 |
| 00R/SSSSSSS0 | 000R/SSSSSS | RRRR/SSS000 | RRRR/SSSSSS | 00RR/SSSSSS0 |
| 00RRR/SSSS0 | 000R/SSSSSS | RRRR/SSS000 | RRRR/SSSSSS | 00RR/SSSSSS0 |
| 00RR/SSSSSS0 | 000R/SSSSSS | RRRR/SSS000 | RRRR/SSSSSS | 00RR/SSSSSS0 |

Table A15. Choices of subjects (20) in Session C for the Abdellaoui *et al.* method.

| Treatment 4 | Treatment 3 | Treatment 1 | Treatment 2 | Treatment 4 |
|-------------|-------------|-------------|-------------|-------------|
| 0RRR/SSSS00 | 00RR/SSSS00 | RRRR/SSSSSS | 000R/SSSSSS | 0RRR/SSSS00 |
| 0RR/SSSS00 | 00RR/SSSS00 | RRRR/SSSSSS | 000R/SSSSSS | 0RR/SSSS00 |
| 0RR/SSSS00 | 00RR/SSSS00 | RRRR/SSSSSS | 000SSSSSSS | 0RRR/SSSS00 |
| 0RRR/SSSS00 | 00RRR/SSSS0 | RRRR/SSSSSS | 000R/SSSSSS | 0RRR/SSSS00 |
| 0RRR/SSSS00 | 00RR/SSSS00 | RRRR/SSSSSS | 000R/SSSSSS | 0RRR/SSSS00 |
| 0RR/SSSS00 | 00R/SSSS00 | RR/SSSSSSSS | 000SSSSSSS | 0R/SSSS00 |
| 0RRR/SSSS00 | 00RR/SSSS00 | RRRR/SSSSSS | 000SSSSSSS | 0RRR/SSSS00 |
| 0RRRR/SSS00 | 00RRR/SSSS0 | RRRRR/SSSSS | 000R/SSSSSS | 0RRRR/SSS00 |
| 0RRR/SSSS00 | 00RRR/SSSS0 | RRRRR/SSSSS | 000RR/SSSSS | 0RRRRR/SS00 |
| 0RR/SSSS00 | 00RR/SSSS00 | RRR/SSSSSSS | 000R/SSSSSS | 0RR/SSSS00 |
| 0RRRR/SSS00 | 00RRRR/SSS0 | RRRRR/SSSS | 000RRR/SSSS | 0RRRR/SSS00 |
| 0RR/SSSS00 | 00RR/SSSS00 | RRR/SSSSSSS | 000R/SSSSSS | 0RR/SSSS00 |
| 0RRR/SSSS00 | 00RR/SSSS00 | RRRR/SSSSSS | 000R/SSSSSS | 0RRR/SSSS00 |
| 0RRR/SSSS00 | 00RR/SSSS00 | RRRR/SSSSSS | 000R/SSSSSS | 0RRR/SSSS00 |
| 0RRR/SSSS00 | 00RR/SSSS00 | RRRR/SSSSSS | 000R/SSSSSS | 0RRR/SSSS00 |
| 0RRR/SSSS00 | 00R/SSSS00 | RRRR/SSSSSS | 000R/SSSSSS | 0RRR/SSSS00 |
| 0RRR/SSSS00 | 00RRR/SSSS0 | RRR/SSSSSSS | 000R/SSSSSS | 0RRR/SSSS00 |
| 0RRR/SSSS00 | 00RRR/SSSS0 | RRRRR/SSSS | 000RRR/SSSS | 0RRRRR/SS00 |
| 0RRR/SSSS00 | 00RR/SSSS00 | RRRR/SSSSSS | 000R/SSSSSS | 0RR/SSSS00 |
| 0RRR/SSSS00 | 00R/SSSS00 | RRR/SSSSSSS | 000SSSSSSS | 0RR/SSSS00 |

Table A16. Choices of subjects (21) in Session *D* for the Abdellaoui *et al.* method.

| Treatment 5 | Treatment 4 | Treatment 2 | Treatment 3 | Treatment 5 |
|---------------|----------------|----------------|---------------|-----------------|
| RRR/SSSS000 | 0RR/SSSS00 | 000SSSSSS | 00R/SSSS00 | RRR/SSSS000 |
| RRRR/SSS000 | 0RRR/SSSS00 | 000R/SSSSS | 00RR/SSSS00 | RRRR/SSS000 |
| RRRR/S/R/S000 | 0R/S/R/SSS/R00 | 000SS/R/S/R/SS | 00S/RRR/SS/R0 | RR/SS/R/S/R/000 |
| RRRRR/SS000 | 0RRRR/SSS00 | 000RR/SSSSS | 00RRR/SSSS0 | RRRRR/SS000 |
| RRR/SSSS000 | 0RRR/SSSS00 | 000R/SSSSS | 00RR/SSSS00 | RRRR/SSS000 |
| RR/SSSS000 | 0R/SSSS000 | 000SSSSSS | 00SSSSSS00 | RR/SSSS000 |
| RRR/SSSS000 | 0RRR/SSSS00 | 00R/SSSSS | 00RR/SSSS00 | RRRR/SSS000 |
| RRRR/SSS000 | 0RRR/SSSS00 | 000SSSSSS | 00R/SSSSSS0 | RRRR/SSS000 |
| RRRR/SSS000 | 0RRRRR/SS00 | 000RRR/SSSS | 00RRRR/SSS0 | RRRRR/SS000 |
| RRR/SS/RR000 | 0RRR/SSSS00 | 000RRR/SSSS | 00RR/SSSS00 | RRRRR/SS000 |
| RRR/SSSS000 | 0RRRR/SSS00 | 000R/SSSSS | 00RR/SSSS00 | RRRRR/SS000 |
| RR/SSSS000 | 0RR/SSSS00 | 000SSSSSS | 00SSSSSS00 | RRR/SSSS000 |
| RRR/SSSS000 | 0RR/SSSS00 | 000SSSSSS | 00R/SSSSSS0 | RRR/SSSS000 |
| RR/SSSS000 | 0RR/SSSS00 | 000SSSSSS | 00R/SSSSSS0 | RRR/SSSS000 |
| RRRRR/SS000 | 0RRRR/SSS00 | 000RR/SSSSS | 00RRR/SSSS0 | RRRRR/SS000 |
| RRRR/SSS000 | 0RRR/SSSS00 | 000R/SSSSS | 00RR/SSSS00 | RRRR/SSS000 |
| RRR/SSSS000 | 0RR/SSSS00 | 000R/SSSSS | 00R/SSSSSS0 | RRR/SSSS000 |
| RRRRR/SS000 | 0RRRR/SSS00 | 000RR/SSSSS | 00RRR/SSSS0 | RRRRR/SS000 |
| RRRRR/SS000 | 0RRRR/SSS00 | 000RR/SSSSS | 00RRR/SSSS0 | RRRRR/SS000 |
| RRRR/SSS000 | 0RRR/SSSS00 | 000R/SSSSS | 00RR/SSSS00 | RRRR/SSS000 |
| RRRR/SSS000 | 0RRR/SSSS00 | 000R/SSSSS | 00RR/SSSS00 | RRRR/SSS000 |

Table A17. Choices of subjects (21) in Session *E* for the Abdellaoui *et al.* method.

REFERENCES

- Abdellaoui, Mohammed, Ahmed Driouchi, Olivier L'Haridon (2011). "Risk aversion elicitation: Reconciling tractability and bias minimization." *Theory and Decision* 71: 63-80.
- Amaldoss, Wilfred, James R. Bettman, and John W. Payne (2008). "Biased but Efficient: An Investigation of Coordination Facilitated by Asymmetric Dominance." *Marketing Science* 27: 903-921.
- Andersen, Steffen, Glenn W. Harrison, Morten Igel Lau and E. Elisabet Rutström (2006). "Elicitation Using Multiple Price List Formats." *Experimental Economics* 9(4): 383-405.
- Bateman, Ian, Brett Day, Graham Loomes, and Robert Sugden (2007). "Can Ranking Techniques Elicit Robust Values?" *Journal of Risk and Uncertainty* 34: 49-66.
- Bosch-Domènech, Antoni, and Joaquim Silvestre (1999). "Does Risk Aversion or Attraction Depend on Income? An Experiment." *Economics Letters* 65: 265-273.
- Bosch-Domènech, Antoni, and Joaquim Silvestre (2006a). "Do the Wealthy Risk More Money? An Experimental Comparison." In Christian Schultz and Karl Vind, eds., *Institutions, Equilibria and Efficiency: Essays in Honor of Birgit Grodal*: 95-106, Berlin: Springer-Verlag.
- Bosch-Domènech, Antoni, and Joaquim Silvestre (2006b). "Reflections on Gains and Losses: A 2x2x7 Experiment." *Journal of Risk and Uncertainty* 33(3): 217-235.
- Bosch-Domènech, Antoni, and Joaquim Silvestre (2006c). "The Gain-Loss Asymmetry and Single-Self Preferences." In Shigeo Kusuoka and Akira Yamazaki, eds., *Advances in Mathematical Economics*, Berlin: Springer Verlag.
- Bosch-Domènech, Antoni, and Joaquim Silvestre (2010). "Averting Risk in the Face of Large Losses: Bernoulli vs. Tversky and Kahneman." *Economics Letters* 107(2): 180-182.
- Dave, Chetan, Catherine C. Eckel, Cathleen A. Johnson, and Christian Rojas (2010). "Eliciting Risk Preferences: When Is Simple Better?" *Journal of Risk and Uncertainty* 41: 219-243.
- Harrison, Glenn W., Eric Johnson, Melayne M. McInnes, and E. Elisabet Rutström (2005). "Risk Aversion and Incentive Effects: Comment." *American Economic Review* 95(3): 897-901.
- Holt, Charles A. (1986). "Preference Reversals and the Independence Axiom." *American Economic Review* 76(3): 508-515.
- Holt, Charles A., and Susan K. Laury (2002). "Risk Aversion and Incentive Effects in Lottery Choices." *American Economic Review* 92(5): 1644-1655.
- Holt, Charles A., and Susan K. Laury (2005). "Risk Aversion and Incentive Effects: New Data without Order Effects." *American Economic Review* 95(3): 902-912.
- Huber, Joel, John Payne, and Christopher Puto (1982). "Adding Asymmetrically Dominated Alternatives. Violations of Regularity and the Similarity Hypothesis." *Journal of Consumer Research* 9: 90-98.
- Isaac, Mark, and James Duncan (2000). "Just Who Are You Calling Risk Averse?" *Journal of Risk and Uncertainty* 20(2): 177-187.
- Lévy-Garboua, Louis, Hela Maafi, David Masclet and Antoine Terracol (2012). "Risk aversion and framing effects." *Experimental Economics* 15: 128-144.
- Machina, Mark J. (1982). "'Expected Utility' Analysis Without the Independence Axiom." *Econometrica* 50(2): 227-323.

Machina, Mark J. (1983). "Generalized Expected Utility Analysis and the Nature of Observed Violations of the Independence Axiom." In B. Stigum and F. Wenstop, eds., *Foundations of Utility and Risk Theory with Applications*, Dordrecht: D. Reidel.

Mas-Colell, Andreu, Michael Whinston, with Jerry Green (1995). *Microeconomic Theory*, Oxford: Oxford University Press.

Parducci, Allen, and Douglas H. Weddell (1986). "The Category Effect with Rating Scales: Number of Categories, Number of Stimuli and Method of Presentation." *Journal of Experimental Psychology: Human Perception and Performance* 12(4): 496-516.

Robinson, Angela, Michael W. Jones-Lee, and Graham Loomes (2001). "Visual Analog Scales, Standard Gambles and Relative Risk Aversion." *Medical Decision Making* 21: 17-27.

Saha, Atanu (1993). "Expo-Power Utility: A Flexible Form for Absolute and Relative Risk Aversion." *American Journal of Agricultural Economics* 75(4): 905-913.

Stewart, Neil, Gordon D. A. Brown, and Nick Carter (2005). "Absolute Identification by Relative Judgment." *Psychological Review* 112(4): 881-911.