JENA ECONOMIC RESEARCH PAPERS

2011 – 034

"One man's meat is another man's poison." An experimental study of voluntarily providing public projects that raise mixed feelings.

by

Werner Güth
Anastasios Koukoumelis
M. Vittoria Levati

www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact markus.pasche@uni-jena.de.

Impressum:

Friedrich Schiller University Jena
Carl-Zeiss-Str. 3
D-07743 Jena
www.uni-jena.de

Max Planck Institute of Economics
Kahlaische Str. 10
D-07745 Jena
www.econ.mpg.de

"One man's meat is another man's poison."

An experimental study of voluntarily providing public projects that raise mixed feelings.

Werner Güth, Anastasios Koukoumelis, M. Vittoria Levati*

Max Planck Institute of Economics, Strategic Interaction Group,

Kahlaische Strasse 10, 07745 Jena, Germany

Abstract

We compare, on the basis of a procedurally fair "provision point" mechanism, bids for a public project from which some gain and some lose with bids for a less efficient public project from which all gain. In the main treatment, participants independently decide which one, if any, of the public projects should be implemented. We also run control treatments where only one of the two projects can be implemented. We find that (a) mixed feelings per se do not affect bidding behavior, and (b) the provision frequency of the project that raises mixed feelings declines significantly when it faces competition from the public good.

JEL Classification: C72, C92, D63, H44

Keywords: Public project, Bidding behavior, Procedural fairness

*Corresponding author. Tel.: +49 3641 686629; fax: +49 3641 686667.
Email address: levati@econ.mpg.de (M. V. Levati).

"*Quod ali cibus est aliis fuat acre venenum*"

Lucretius, *De Rerum Natura*, Book IV, line 637

1 Introduction

There exists an impressive number of studies, both theoretical and experimental, investigating the private provision of threshold public goods. These are public goods that – once their cost, typically referred to as the provision point, has been met – cannot but be provided in their entirety (see, e.g., Bagnoli and Lipman 1989; Bagnoli and Mckee 1991; Marks and Croson 1998; Cadsby and Maynes 1999; Cadsby, Croson, Marks and Maynes 2008; Spencer, Swallow, Shogren and List 2009). There is also work focusing on public bad problems, usually described as commons, where individuals exploit a commonly-owned resource yielding negative externalities (see, e.g., Ostrom, Gardner and Walker 1994; Andreoni 1995; Burlando and Hey 1997; Sonnemans, Schram and Offerman 1998; Moxnes and van der Heijden 2003).

As suggested by the idiom in our title,[1] we consider threshold public projects that raise mixed feelings, i.e., indivisible public projects from which some parties benefit, but others suffer. The Strait of Messina Bridge, which is going to connect Sicily to mainland Italy, is an appropriate example. Some people see the bridge as a job-creation scheme and a boost for the local economy; therefore, they attach a positive value to it or, to paraphrase our idiom, they regard the project as "meat". Others, however, are concerned about the environmental impact of the bridge and its resistance to earthquakes; thus, they attach a negative value to the project, that is they consider it to be "poison". Due to the heated controversy that surrounded the construction of the bridge, the project was initially abandoned. Then,

[1] The idiom corresponds to the English translation of the opening quote.

in March 2009, the Italian government gave the final go-ahead for it.

The presence of opposite valuations of public projects raises deep philosophical questions: should society require the unanimous consent of its members in order to provide such projects, and if so, how could its individual members exercise their veto power? On the basis of our procedurally fair provision point mechanism, society members can prevent the realization of a public project that raises mixed feelings by bidding sufficiently low, or even negatively. The provision mechanism is procedurally fair in the sense that all parties are treated equally according to some objective criteria, namely their bids, rather than according to their idiosyncratic (and usually privately known) characteristics.

To the best of our knowledge, this is the first study of behavior in the presence of public projects raising mixed feelings that relies on an axiomatically derived and procedurally fair provision point mechanism. Yet, the rules of the mechanism define only a game form. To implement it in the laboratory we need to specify a proper game. We focus on the simplest possible scenario: a public project that raises mixed feelings competes with a traditional public good project, and society consists of two parties whose values of the projects are commonly known.[2] Both projects are indivisible and well specified, i.e., they can not be provided in part and their costs are predetermined and, we assume, known to all. Both projects are efficient, but the project that raises mixed feelings is more efficient than its alternative. Efficiency is measured in terms of monetary surplus (i.e., the sum of the individual values attached to the project minus its provision cost).[3]

Our principal objective is to examine whether the public project that

[2] Assuming two players dramatically reduces the set of equilibria (to be discussed in Section 3) and allows for a clear-cut benchmark equalizing payoffs.

[3] Applying this efficiency criterion is justified because the provision mechanism allows for monetary compensations.

raises mixed feelings is provided in the face of competition from a public good project that harms nobody but is less efficient: in our main experimental treatment, participants decide to provide either one or none of the two projects. Which project, if any, is provided depends (given the projects' costs) on the parties' bids. If the sum of bids for each project suffices to cover the corresponding cost, then the project that generates the larger surplus according to bids (defined as the difference between sum of bids and cost) is provided, and the parties' payments are derived axiomatically.[4] If, on the other hand, the sum of bids for each project falls short of the corresponding cost, then no project is provided and the parties' payments are null.

In addition, we run control treatments where only one project is at stake and the participants decide whether to provide it or not. The public project that raises mixed feelings is expected to be nearly always provided in the treatment where it constitutes the sole option. After all, it is efficient and the party benefiting from it can compensate the other party. A comparison of bid levels and provision frequencies in this control and the main experimental treatment allows us to determine whether and to what extent the provision of a public project that raises mixed feelings is affected by the availability of an alternative project from which all benefit.

Since our provision point mechanism has large sets of equilibria, the non-provision of the project that raises mixed feelings may be attributed to coordination failure. The treatment with the standard public good as the unique option serves to control for this possibility: if bid levels and/or provision frequencies in this and the other control treatment differ, then we may infer that "mixed feelings" impact behavior.

In the next section, we derive axiomatically the procedurally fair pro-

[4]Obviously, if only one project generates surplus according to bids, then that project is provided.

vision point mechanism that applies to our setting. Then we define the specific experimental game and its solutions (section 3). After describing the experimental protocol (section 4), we present the experimental findings (section 5). In our conclusions (section 6) we summarize and discuss our results.

2 The procedurally fair provision point mechanism

Let P denote a non-empty set of indivisible and well-specified public projects p, and let $N = \{1, \ldots, n\}$, with $N \subset \mathbb{N}$ and $n \geq 2$, be a group of bidders or players $i = 1, \ldots, n$. The cost of providing any particular project p, denoted by $C(p) \in \mathbb{R}$, is commonly known.[5] Each player i submits a bid plan $\boldsymbol{b}_i = (b_i(p) \in \mathbb{R} : p \in P)$, resulting in a bid vector $\boldsymbol{b} = (\boldsymbol{b}_1, \ldots, \boldsymbol{b}_n)$. For each project p, we refer to the difference between the sum of the players' bids and its cost (that is $\sum_{i=1}^{n} b_i(p) - C(p)$) as the project's surplus according to bids. For all possible vectors $\boldsymbol{b}$, the provision rule must specify, first, which $p^* \in P$, if any, will be provided, and, second, which amount $c_i(\boldsymbol{b}) \in \mathbb{R}$ should be paid by each player i.

We impose the following ethical or procedural fairness requirements.[6]

(A.1) "Equal payoffs according to bids" affirms that if $p^* \in P$ is provided, then

$$b_i(p^*) - c_i(\boldsymbol{b}) = b_j(p^*) - c_j(\boldsymbol{b}) \quad \forall i, j, \text{ and } \boldsymbol{b}.$$

(A.2) "Efficiency according to bids" means that the chosen $p^* \in P$ satisfies

$$\sum_{i=1}^{n} b_i(p^*) - C(p^*) = \max_{p \in P}\{0, \sum_{i=1}^{n} b_i(p) - C(p)\},$$

[5] "Costs" could be negative, but we do not consider this case here.

[6] See Güth and Kliemt (2011) for a more elaborate discussion of these requirements.

i.e., the implemented project generates the maximal non-negative surplus according to bids.

(A.3) "Balanced budget" requires that the individual payments $c_i(\boldsymbol{b})$ equal zero if no public project is provided, whereas they add up to $C(p^*)$ if p^* is provided. Formally,

$$c_i(\boldsymbol{b}) = 0 \quad \forall i \in N \qquad \text{if no public project is provided, and}$$
$$\textstyle\sum_{i=1}^n c_i(\boldsymbol{b}) = C(p^*) \qquad \text{if } p^* \in P \text{ is provided.}$$

Thus, if there is no $p \in P$ such that $\sum_{i=1}^n b_i(p) \geq C(p)$, no public project is provided and $c_i(\boldsymbol{b}) = 0$ for all $i \in N$. If, instead, there exists a $p^* \in P$ satisfying (A.2), then (A.1) implies $b_i(p^*) - c_i(\boldsymbol{b}) = \Delta(\boldsymbol{b})$ for all $i \in N$. Aggregating over all n bidders yields $\sum_{i=1}^n b_i(p^*) - \sum_{i=1}^n c_i(\boldsymbol{b}) = n\Delta(\boldsymbol{b})$, which employing (A.3) can be written as $\sum_{i=1}^n b_i(p^*) - C(p^*) = n\Delta(\boldsymbol{b})$, where $\Delta(\boldsymbol{b}) = \frac{\sum_{i=1}^n b_i(p^*) - C(p^*)}{n} \geq 0$. It follows that

$$c_i(\boldsymbol{b}) = b_i(p^*) - \Delta(\boldsymbol{b}) = b_i(p^*) - \frac{\sum_{j=1}^n b_j(p^*) - C(p^*)}{n}$$

for all $i \in N$. Hence, the procedurally fair provision point mechanism requires the implementation of the project that generates the maximal non-negative surplus according to bids, and that each bidder i pays $c_i(\boldsymbol{b})$. As the non-negative surplus according to bids is equally distributed among all bidders, nobody has to pay more than his bid, an essential veto requirement for a liberal society.

For each player $i \in N$, let $v_i(p) \in \mathbb{R}$ denote i's true value of project $p \in P$. An additional property of this mechanism is overbidding proofness, meaning that any bid plan prescribing overbidding for a project $(b_i(p) > v_i(p))$ is weakly dominated.[7]

[7]The provision point mechanism has therefore the nice property of satisfying the in-

So far we have defined a game form. In the next section we specify a proper game.

3 The experimental game

We focus on the simplest possible case: there are two players, $N = \{1, 2\}$, and two public projects, $P = \{x, y\}$, whose costs $C(x)$ and $C(y)$ are positive. Project x implies true values $v_1(x) < 0 < v_2(x)$. Consequently, its implementation would yield mixed feelings. Project y is a normal public good: $0 < v_1(y) < v_2(y)$. Both projects are assumed to be efficient, that is $S(x) = v_1(x) + v_2(x) - C(x) > 0$ and $S(y) = v_1(y) + v_2(y) - C(y) > 0$. Furthermore, we impose $S(x) > S(y)$, which obviously implies that $v_1(x) < v_1(y) < v_2(y) < v_2(x)$.[8] The individuals' true values and the projects' costs are commonly known.

We made a deliberate decision to have one player valuing both projects more than the other player in order not to confound the fairness of the game form with the symmetry of the proper game. This may have rendered the experimentally implemented game unfair. In this sense, our experiment can be considered as a worst-case scenario for observing fairness in a procedurally fair mechanism.

Each player $i = 1, 2$ submits a bid vector $\boldsymbol{b}_i = (b_i(x), b_i(y))$. Bids are restricted to the interval $\left[\underline{b}, \overline{b}\right]$, where $\underline{b} < v_1(x)$ and $\overline{b} > v_2(x)$. The provision mechanism presented in Section 2 determines each player's monetary payoff

dividual rationality condition. However, it is not incentive compatible because it is not underbidding proof.

[8] If the project that raises mixed feelings were the less efficient one, the choice between the two projects would be unambiguous.

as a function of $\boldsymbol{b} = (\boldsymbol{b}_1, \boldsymbol{b}_2)$:

$$\pi_i(\boldsymbol{b}) = \begin{cases} 0 & \text{if } b_1(x) + b_2(x) < C(x) \text{ and } b_1(y) + b_2(y) < C(y), \\ v_i(x) - c_i(x) = v_i(x) - b_i(x) + \frac{b_1(x)+b_2(x)-C(x)}{2} & \\ & \text{if } b_1(x) + b_2(x) - C(x) \geq \max\{0, b_1(y) + b_2(y) - C(y)\}, \\ v_i(y) - c_i(y) = v_i(y) - b_i(y) + \frac{b_1(y)+b_2(y)-C(y)}{2} & \\ & \text{if } b_1(y) + b_2(y) - C(y) \geq \max\{0, b_1(x) + b_2(x) - C(x)\}. \end{cases}$$

A player that submits a negative bid for a project that gets implemented is compensated by his fellow player; the latter's bid has to be positive, considering that costs are positive and only projects with a non-negative surplus according to bids are eligible for implementation.

If the minimum feasible bid, $\underline{b}$, is sufficiently below $v_1(x)$, there exist many non-provision equilibria in which both bidders veto the two projects. For this to hold, each player must submit bids that comply with

$$b_i(p) < C(p) - v_j(p) \quad i, j = 1, 2 \ (i \neq j), \quad p = x, y. \tag{1}$$

In this case, if bidder j wanted to secure project p, he would have to overbid and suffer a loss.[9]

Let us now turn to the provision equilibria, of which there exists an abundance (like in standard provision point mechanisms). We limit our analysis to two types of provision equilibria:

(a) equilibria based on truthful bidding for the non-implemented project;[10]

(b) equilibria where both parties veto the non-implemented project.

[9]Note that in our experimental game the assumptions $S(x) > 0$ and $v_1(x) < 0$ imply that $v_2(x) > C(x)$. Thus, these assumptions rule out a non-provision equilibrium in which both parties bid zero for both projects.

[10]Because of the players' incentives to underbid, no equilibrium exists in which they bid truthfully for the implemented project (except for degenerate cases).

To illustrate these equilibria, assume that x is implemented.[11] Starting with equilibria of type (a), that is both players bid truthfully for y, the lower bound for project x's surplus according to bids is $S(y)$. Hence in equilibrium the following holds:

$$b_1^*(x) + b_2^*(x) = C(x) + S(y). \tag{2}$$

Additionally, no player i $(= 1, 2)$ should have an incentive to unilaterally increase $b_i^*(y)$ to $v_i(y) + \epsilon$, thereby implementing y rather than x. The condition for this to be true is

$$v_i(y) - v_i(y) - \epsilon + \frac{S(y) + \epsilon}{2} \leq v_i(x) - b_i^*(x) + \frac{S(y)}{2}$$

or

$$b_i^*(x) \leq v_i(x) + \frac{\epsilon}{2}. \tag{3}$$

In equilibria of type (b), each bidder vetoes the non-implemented project y by submitting bids that satisfy (1). In this case, the lower bound for project x's surplus according to bids is 0 so that, in equilibrium, the individual bids for the implemented project must add up to its cost:

$$b_1^*(x) + b_2^*(x) = C(x). \tag{4}$$

Furthermore, overbidding proofness requires

$$b_i^*(p) \leq v_i(p) \quad i = 1, 2, \quad p = x, y. \tag{5}$$

Since $S(y) > 0$, (4) is more restrictive than (2), the implication being that the set of provision equilibria of type (b) is smaller than that of type (a).[12]

[11] It is worth mentioning that with our parameterization (described in Section 4.2) no equilibria of type (a) exist in which y is provided and the players bid truthfully for x.

[12] More generally, there exists a continuum of provision equilibria where the individual bids for the non-implemented project (let this be again y) range from the threshold below which y is vetoed to y's true value. These equilibria are characterized by $b_1^*(x) + b_2^*(x) = C(x) + k$, where $k \in (0, S(y))$ is the lower bound for project x's surplus according to bids.

The equality axiom (A.1) implies only equal payoffs according to bids. It does not necessarily imply equal monetary payoffs. Within the sets of type (a) and type (b) provision equilibria, the equilibrium that equalizes the two players' monetary payoffs for the selected public project constitutes an appropriate benchmark for our analysis. Consider first equilibria of type (a) in which, according to our parameterization (see Section 4.2), only project x can be implemented. Imposing equality in the sense of $v_1(x) - b_1^*(x) = v_2(x) - b_2^*(x)$ subject to (2), we obtain the benchmark bid

$$b_i^*(x) = \frac{C(x) + S(y) + v_i(x) - v_j(x)}{2} \quad i = 1, 2,\ i \neq j. \tag{6}$$

Consider now equilibria of type (b), and suppose once more that x is implemented according to $\boldsymbol{b}^*$. The constraint is now given by (4), so that the benchmark bid reduces to

$$b_i^*(x) = \frac{C(x) + v_i(x) - v_j(x)}{2} \quad i = 1, 2,\ i \neq j. \tag{7}$$

If, instead, y is implemented in a type (b) equilibrium, then we get

$$b_i^*(y) = \frac{C(y) + v_i(y) - v_j(y)}{2} \quad i = 1, 2,\ i \neq j. \tag{8}$$

General truth-telling (i.e., $b_i(p) = v_i(p)$ for $i = 1, 2$ and $p = x, y$) also implies equal payoffs, but it does not qualify as an equilibrium as players have an incentive to underbid.[13]

[13] There is a large set of equal-payoff equilibria continuously connecting (6) and (7), where $S(y)$ is replaced with $k \in (0, S(y))$.

4 The experimental design

4.1 Treatments

We study three treatments that build on the basic game described and analyzed above. In the main treatment, named M, pairs of participants bid for public projects x and y, and implement the project that is more efficient according to bids, provided that its surplus according to bids is non-negative. We also run two control treatments where just one public project (either x or y) is at stake, and the relevant decision is whether to provide it or not. We refer to the treatment where participants bid only for x as treatment X, and to the treatment where they bid only for y as treatment Y. Player i's ($i = 1, 2$) monetary payoff in treatment X is

$$\pi_i(\boldsymbol{b}) = \begin{cases} v_i(x) - b_i(x) + \frac{b_1(x)+b_2(x)-C(x)}{2} & \text{if} \quad b_1(x) + b_2(x) \geq C(x), \\ \\ 0 & \text{if} \quad b_1(x) + b_2(x) < C(x). \end{cases}$$

Similarly, in treatment Y,

$$\pi_i(\boldsymbol{b}) = \begin{cases} v_i(y) - b_i(y) + \frac{b_1(y)+b_2(y)-C(y)}{2} & \text{if} \quad b_1(y) + b_2(y) \geq C(y), \\ \\ 0 & \text{if} \quad b_1(y) + b_2(y) < C(y). \end{cases}$$

In both control treatments, there exists a continuum of provision equilibria where the two players satisfy condition (5) and bid collectively exactly enough in order to meet the provision cost of the project (similarly to the type (b) equilibria analyzed above).

Comparing the frequency of provision of x in treatments M and X allows us to investigate whether bids for x are affected by the presence of an alternative project. We are also interested in (*i*) differences in bidding behavior between individuals who attach different values to the projects, and (*ii*) how these individuals exercise their veto power. In particular, who vetoes x more often? The bidder that needs compensation, or the bidder that is obliged to compensate his fellow player?

The non-provision of x in treatment X can be attributed either to the presence of mixed feelings or to the bidders' inability to coordinate. Since the non-provision of y in Y can be attributed *only* to coordination failure, comparing the frequency of provision of x in X with the frequency of provision of y in Y we can assess whether and to what extent the nature of the public project per se affects bidding behavior.

4.2 Experimental parameters

According to our parameterization, the players' induced valuations of the public projects were $v_1(x) = -40$, $v_2(x) = 140$, $v_1(y) = 40$, and $v_2(y) = 80$. The valuations were expressed in terms of ECUs (Experimental Currency Unit), with 5 ECU = €1. Bids could be any integer number between -200 and 200 ECUs. The cost of providing x, $C(x)$, was 30 ECUs; that of providing y, $C(y)$, was 70 ECUs. Given these parameter values, the projects' monetary surpluses were $S(x) = 70$ and $S(y) = 50$.

The threshold below which player 1 (player 2) exercises his veto power on the provision of x, as determined by (1), is $b_1(x) = -110$ ($b_2(x) = 70$). The corresponding values for the players' vetoes on y are $b_1(y) = -10$ and $b_2(y) = 30$.

In treatment X, the equilibrium bids that equalize the players' monetary payoffs are $b_1^*(x) = -75$ and $b_2^*(x) = 105$, yielding $u_1(\boldsymbol{b}^*) = u_2(\boldsymbol{b}^*) = 35$. In treatment Y, the equilibrium bids that equalize the players' monetary payoffs are $b_1^*(y) = 15$ and $b_2^*(y) = 55$, yielding $u_1(\boldsymbol{b}^*) = u_2(\boldsymbol{b}^*) = 25$. In treatment M, the above benchmark solutions correspond to type (b) equilibria. In the case of type (a) equilibria, given our parameter values, only project x can be provided and, to equalize their monetary payoffs, the players should bid $b_1^*(x) = -50$ and $b_2^*(x) = 130$. These bids entail a surplus according to bids of 50 ($= S(y)$).

4.3 Procedures

The experiment was programmed in z-Tree (Fischbacher 2007) and conducted in the experimental laboratory of the Max Planck Institute of Economics (Jena, Germany). The subjects were undergraduate students from the Friedrich-Schiller University of Jena. They were recruited using the ORSEE (Greiner 2004) software. Upon entering the laboratory, the subjects were randomly assigned to visually isolated computer terminals.

The three treatments were run one-shot in a within-subject design, i.e., participants played each treatment exactly once within a given session.[14] At the beginning of each session, each participant was assigned the role of either low-value bidder (player 1) or high-value bidder (player 2), a role which he retained throughout the session. We implemented a so-called "perfect stranger" protocol, which ensures that nobody meets the same person in more than one treatment.

Each of the three treatments was presented separately in a different part of the experiment. Instructions (reproduced in the appendix) were distributed and read aloud in each of the three parts, and participants had the chance to go through a series of control questions and three practice

[14]One-shot games eliminate the possibility of strategic behavior that may exist in early periods of finitely repeated games. Moreover, one-shot games are deemed to conform better to field conditions (e.g., Rondeau, Schulze and Poe 1999; Spencer et al. 2009).

periods.[15] Once the experimenter ensured that everyone understood the game, the corresponding treatment started and subjects submitted their bids. Only after all participants made their decisions were the instructions for the following treatment distributed.

To minimize path dependence (i.e., dependence of current bids on previous outcomes), subjects did not receive any feedback or payment until the end of the experimental session. At the end of the session, one treatment was chosen randomly and subjects were paid according to their decisions in that treatment.[16] Subjects knew about these procedures in advance.

Instead of considering all possible permutations of our treatments, we concentrate on treatment sequences where M is played either at the very beginning or at the very end. The MXY and MYX sequences, which from now on will be referred to as the M^F sequences (F stands for first), acknowledge the potential importance of initial play (i.e., play that is uncontaminated by other features). In the XYM and YXM sequences, which from now on will be referred to as the M^L sequences (L stands for last), we recognize the fact that previous experience of the public projects might help people recognize the relative efficiency of x compared to y.

We ran one session per sequence. Each session involved 32 participants matched in pairs. With the bidders' roles remaining constant throughout each session, we had 16 low-value and 16 high-value bidders for each treatment of any given sequence. Sessions lasted about 2 hours. Earnings ranged from €2.00 to €42.00. The average earnings were €10.16 (inclusive of a €5.00 show-up fee).

[15]The practice periods did not involve any interaction (the other's decision was selected randomly by the computer). Their sole aim was to familiarize the participants with the game and its incentives (no payments were associated with them).

[16]This design should minimize confounding effects among treatments and avoid subjects averaging their earnings across games.

5 Results

Let us denote, for convenience, i's bid for p in treatment $T = \{M, X, Y\}$ by $b_i^T(p)$, and check for the presence of order effects, i.e., examine how bids placed in the context of a certain treatment vary across the four sequences of treatments that we consider. A series of rank-based tests reveals that bids for x in treatments M and X, as well as bids for y in treatment Y, are not affected by the order in which the treatments are played.[17] However, bids for y in treatment M do exhibit order effects.[18] Nevertheless, we cannot reject the null hypothesis that the $b_i^M(y)$ series in the XYM and YXM sequences are drawn from the same distribution.[19] These results indicate that we can pool our data only partially, that is we can pool them according to whether M is played either at the beginning or at the end of the sequence.

How can we explain the observed order effects? Figure 1 plots histograms of the $b_i^M(y)$ values in the M^F and M^L sequences (64 observations per panel). More than 20% of the observations are negative in the former case, whereas none of them is negative in the latter. The distribution of $b_i^M(y)$ in the M^L sequences appears to be located on the right of the distribution of the same series in the M^F sequences (see also the descriptive statistics reported in the fourth and eighth columns of Table 1). It seems that participants who have experienced both public projects (irrespectively of the order in which they were implemented) wish to increase the likelihood of providing y when

[17] On the basis of the Brunner, Dette, and Munk test, we cannot reject the null hypothesis that the four $b_i^M(x)$ series in the sequences that we consider have identical distributions (p-value = 0.38). The same applies to the $b_i^X(x)$ and $b_i^Y(y)$ groups of series (with p-values equal to 0.56 and 0.45, respectively).

[18] The Brunner *et al.* test statistic is in this case significant at the 0.01 level.

[19] The p-value of the Kolmogorov-Smirnov test equals 0.63. We compared as well $b_i^M(y)$ in the MXY and MYX sequences with the aim of finding out whether recruitment was unbiased. The p-value of the test equals 0.96 suggesting that randomization worked (i.e., the participants were sufficiently similar).

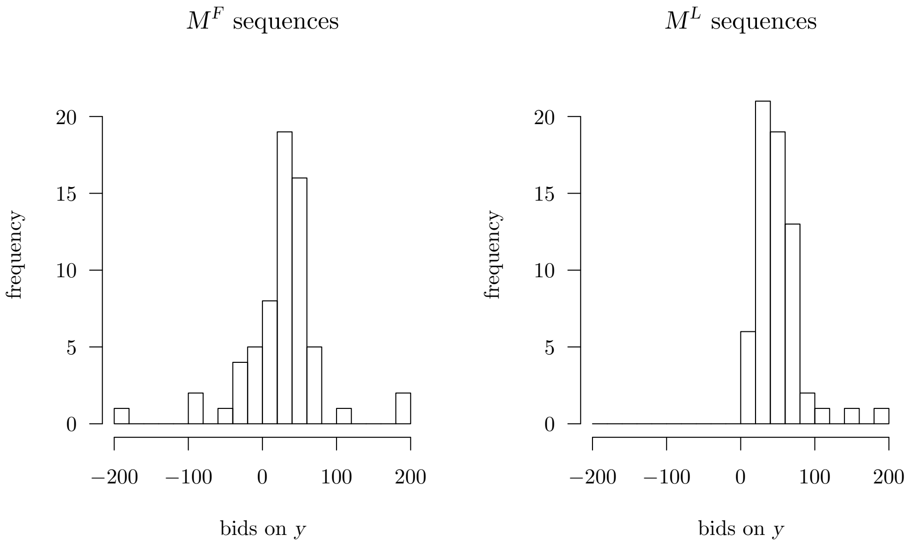

Figure 1: Histograms of the $b_i^M(y)$ bids in the M^F and M^L sequences.

both projects are made available.[20] In Section 5.1.2 we show that the order effect is mainly triggered by the high-value bidders.

5.1 Bidding behavior

In what follows we analyze how individuals place their bids on the two projects. Table 1 reports summary statistics of bid levels in treatments M, X, and Y (the data are partially pooled). In both panels, the $b_i^M(x)$ series display the greatest variation[21] and the lowest measures of location (mean and median values).

Next, we examine whether bids for x are affected by the availability of y. Figure 2 compares kernel density plots of the observed bids for x in

[20] Learning by the participants cannot account for $b_i^M(y)$ being higher in the M^L than in the M^F sequences, as it is not possible to reject the null hypothesis that the $b_i^Y(y)$ series in the YXM and MXY sequences have identical distributions (p-value = 0.34; two-sided Wilcoxon rank sum test)

[21] The standard deviation of the $b_i^M(x)$ exceeds all others. In addition, no other series displays a larger difference between maximum and minimum values, or a larger interquartile range.

Table 1: Summary statistics of bids in our partially pooled dataset.

	M^F sequences				M^L sequences			
	$b_i^M(x)$	$b_i^M(y)$	$b_i^X(x)$	$b_i^Y(y)$	$b_i^M(x)$	$b_i^M(y)$	$b_i^X(x)$	$b_i^Y(y)$
Minimum	−200.0	−200.0	−100.0	−150.0	−200.0	0.0	−80.0	−150.0
1^{st} quartile	−60.0	10.0	−60.0	20.0	−50.0	28.8	−50.0	30.0
Median	15.0	30.0	46.0	32.5	15.0	40.0	60.0	45.0
Mean	10.8	22.6	24.5	35.5	19.3	46.3	30.4	42.6
2^{nd} quartile	100.0	45.0	100.0	56.2	100.0	60.0	100.0	60.0
Maximum	200.0	200.0	200.0	200.0	200.0	200.0	180.0	140.0
Std. deviation	98.4	55.3	87.2	43.2	83.9	30.9	80.4	34.1

Note: 64 observations per series (there are 32 participants in each session).

treatments X and M, conditioned on whether M is played first or last. For the M^F sequences, there is a gap between the M- and the X-treatment estimates. Following the Wilcoxon signed-rank test, the two distributions are significantly different (two-sided test, p-value = 0.042). However, the assumptions of the test appear to be violated.[22] Thus, we are inclined to rely on the binomial sign test, which employs less information than the Wilcoxon test but is less demanding with regard to the nature of the distributions under study. In the present case, the 95% confidence interval for the sign test statistic p contains 0.5, implying that there is no difference between the two sets of bids.

The situation is clearer for the M^L sequences: the kernel density estimates are close (right panel of Figure 2) and the two tests yield consistent results (the p-value of the two-sided Wilcoxon signed-rank test equals 0.12, the 95% confidence interval of the sign test statistic is 0.34 to 0.65).

How do individuals modify their bids for x between treatments? In the M^F sequences, the majority of subjects either increase (42.2%) or do not

[22] It is doubtful whether the resulting difference scores could be drawn from a symmetric population. In fact, tests that they are symmetric about an unknown median reject the null hypothesis of symmetry at conventional levels.

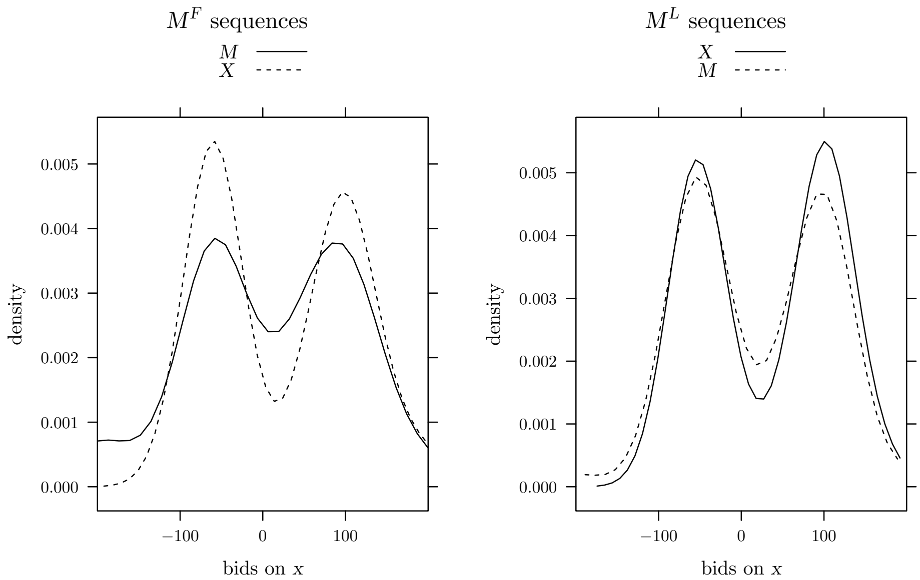

Figure 2: Kernel density estimates of $b_i^M(x)$ and $b_i^X(x)$ in the M^F and M^L sequences.

change (28.1%) their bids between treatments M and X. The rest of the players (19 out of 64) lower their bids, about half of them by less than 10 ECUs. In the M^L sequences, 39.1% of the participants bid the same amount in both treatments. Switching from X to M, 19 participants increase their bids by an average amount of 19.4 ECUs, and 20 participants decrease their bids by an average amount of 53.7 ECUs (thus the overall effect is negative). In sum, participants bid less for x whenever it faces competition from y (especially, when they are given the choice between x and y before having to decide whether to provide x or not), but this difference is not statistically significant.

5.1.1 Low-value and high-value bidders

What is the relationship between $b_i^M(x)$ and $b_i^X(x)$ for the subsamples of low-value ($i = 1$) and high-value ($i = 2$) bidders? Figure 3 draws boxplots of

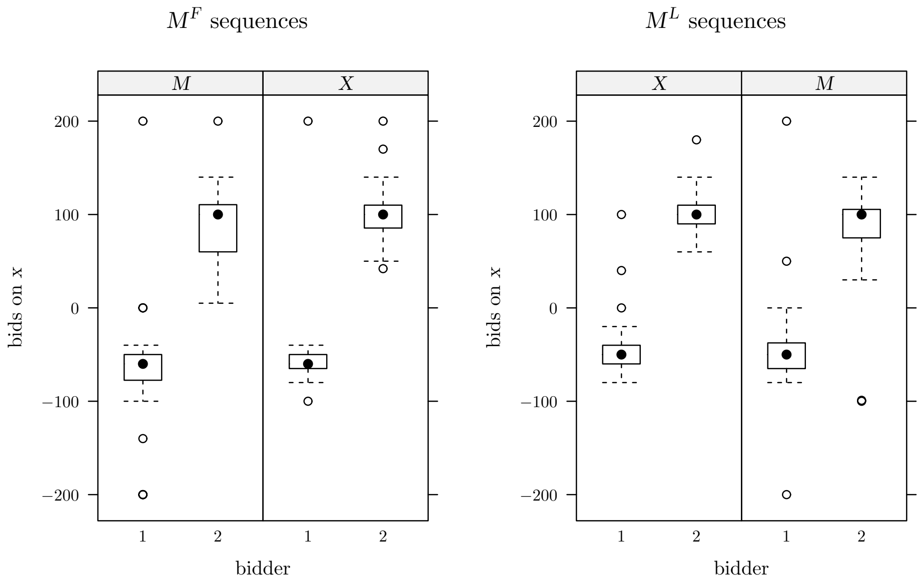

Figure 3: Boxplots of $b_i^T(x)$, $T = M, X$, $i = 1, 2$, in the M^F and M^L sequences (32 observations per boxplot).

bids for x separately for each type of bidder. As expected, low-value (high-value) bidders place predominantly negative (positive) bids. In addition, the bids of both types of bidders are similar, both between treatments and between sequences.

Actually, the hypothesis that the distributions of $b_1^M(x)$ and $b_1^X(x)$ are identical cannot be rejected: the p-value of the Wilcoxon signed-rank test equals 0.29 for the M^F and 0.90 for the M^L sequences. The same applies to the distributions of $b_2^M(x)$ and $b_2^X(x)$ for the M^F sequences (p-value = 0.14), and, once we acknowledge the presence of certain outliers, the M^L sequences.[23] Hence, our finding that players do not differentiate their bids for x holds even when we restrict our attention to either the low-value or

[23]More specifically, two participants bid in treatment M −100 and −99 ECUs, while the minimum bid of the remaining participants is 30 ECUs. Once we exclude these two observations, the Wilcoxon signed-rank test statistic becomes insignificant (the p-value changes from 0.036 to 0.110, and could even change to 0.189 if we were to exclude a further participant whose bid of 180 in treatment X is an outlier too).

Table 2: Frequency of satisfying the conditions for vetoing projects x and y by bidders 1 and 2.

Bidder	M^F sequences				M^L sequences			
	M		X	Y	M		X	Y
	x	y			x	y		
1	5	4	0	3[3]	1	0	0	1
2	10[1]	10[2]	4	2	6	0	2[4]	0

[1] $b_2^M(x) = 50$ once, but x is provided.
[2] $b_2^M(y) = -20$ once, but y is provided.
[3] $b_1^Y(y) = -20$ once, but y is provided.
[4] $b_2^X(x) = 60$ once, but x is provided.

the high-value bidders.

Finally, Table 2 reports the number of times (out of $16 + 16 = 32$) that the players' bids satisfy condition (1) for vetoing a project.[24] Project x in treatment M is the most frequently vetoed project, and the low-value bidder is the one that exercises his veto power more often. The players veto more often in the M^F than in the M^L sequences. Note that even if the bids of one group member satisfy condition (1), the project *can* be implemented if the other group member overbids. The footnotes of Table 2 identify four such cases.

5.1.2 Truthful bidding

Do players report their true values? Do mixed feelings affect the extent of truthful bidding? Does the discrepancy between the observed bids for x and its true value depend on the presence of an alternative project? To address these questions, we construct the following variable, representing the relative

[24]That is $b_1^T(x) < -110$, $b_2^T(x) < 70$ for vetoing x when $T = M, X$, and $b_1^T(y) < -10$, $b_2^T(y) < 30$ for vetoing y when $T = M, Y$ (see page 12).

Table 3: The sign of the $R_i^T(p)$ values in all treatments and for both projects.

	M		X	Y
	x	y		
M^F sequences	55,5,4	59,1,4	59,2,3	59,2,3
M^L sequences	51,5,8	54,4,6	49,8,7	55,4,5

Note: The table entries represent the numbers of negative, zero, and positive $R_i^T(p)$ values in each case.

deviation of the observed bid $b_i^T(p)$ from the true value $v_i(p)$

$$R_i^T(p) = \begin{cases} -(b_i^T(p) - v_i(p))/v_i(p) & \text{if } i = 1 \text{ and } p = x, \\ (b_i^T(p) - v_i(p))/v_i(p) & \text{otherwise.} \end{cases}$$

Table 3 shows that players rarely report their true values. Truthful bidding typically ranges from 1.6% to 7.8%, rising once to 12.5% (sequences M^L, treatment X). In fact, in all cases, the majority of the $R_i^T(p)$ values are negative, implying that people avoid dominated choices. On the other hand, overbidding is often associated with outlier observations (the most relevant example is one participant whose four bids equal 200 ECUs).[25]

Figure 4 plots the average values of the $R_i^T(p)$ series separately for v_1 and v_2 bidders. The two types of bidders differ substantially in their attitude towards truthful bidding, and these differences often depend on the order in which the treatments were played. Low-value bidders bid, on average, more truthfully for x (i.e., their average $R_i^T(x)$ values are closer to zero) in the M^L than in the M^F sequences. Experiencing at first project x by

[25] We also conducted Wilcoxon signed rank tests to test the null hypothesis that the true location of the various $R_i^T(p)$ series equals 0. In all cases the null hypothesis is clearly rejected in favor of the alternative hypothesis that the series' true location is less than 0 (all p-values < 0.01).

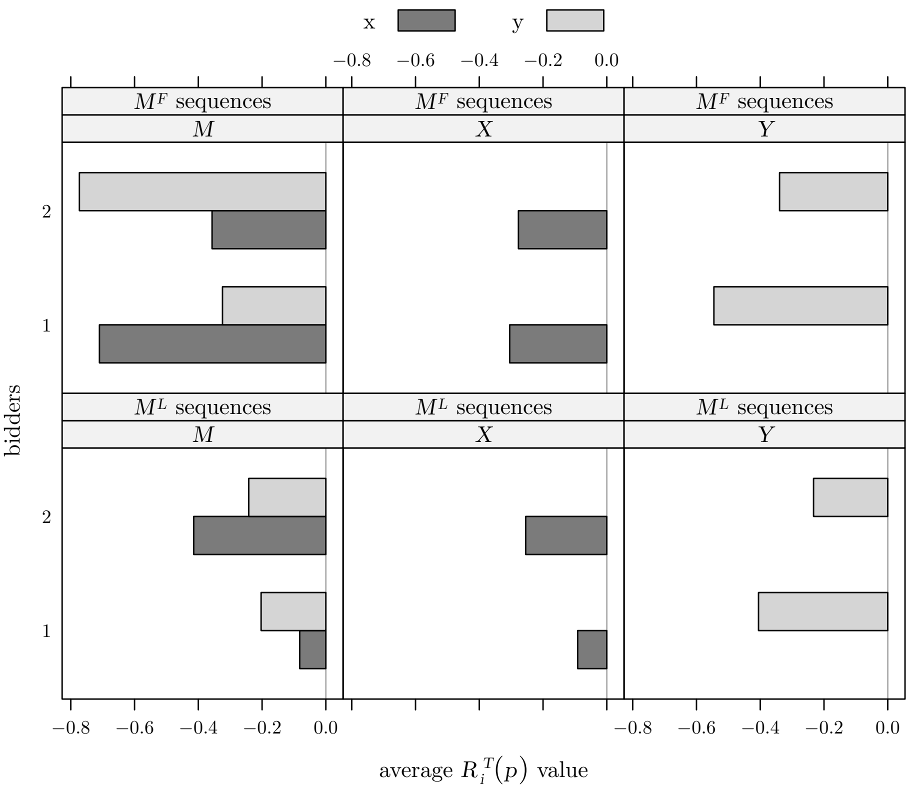

Figure 4: Average relative deviations of observed bids from true values (1 stands for low-value and 2 for high-value bidders).

itself seems to help them realize its relative efficiency. On the other hand, compared to M^F, the M^L sequences trigger, on average, more truthful bids for y from the high-value bidders. Formal testing verifies that the observed order effects are due to the high-value bidders.[26]

[26] We used once again the Brunner *et al.* test to evaluate the hypothesis that the four $b_1^M(y)$ series have identical distributions. The p-value of the test statistic equals 0.28. The p-value of the same test statistic using the $b_2^M(y)$ series equals 0.0002.

Table 4: Average absolute deviations of actual bids from benchmark bidding.

	Bidder	Type (a) $b_i^M(x)$	Type (b) $b_i^M(x)$	Type (b) $b_i^M(y)$	$b_i^X(x)$	$b_i^Y(y)$
M^F sequences	1	42.16	44.09	30.16	25.00	19.06
	2	45.59	31.28	39.34	22.19	16.91
M^L sequences	1	28.59	39.84	18.75	31.97	20.66
	2	48.66	30.34	13.59	16.25	11.31

5.1.3 Benchmark bidding

The benchmark solutions are the equilibrium bids that equalize the players' monetary payoffs.[27] Table 4 reports, for each type of bidder, the averages of the absolute values of the deviations of the actual bids from the benchmark solutions, that is $\sum_{i=1}^{32} |b_i^T(p) - b_i^*(p)|/32$. For both sequences, bids for x tend to deviate more from the benchmark solutions than bids for y. This holds whether the two projects are offered as alternatives (whatever the benchmark for x) or individually. In addition, for x, competition from y results in larger deviations from the benchmark solutions, except for $b_1^M(x)$ in the M^L sequences when the equilibrium is of type (a).

Deviations from the equal-payoff equilibrium do not preclude bidders 1 and 2 from earning, on average, nearly the same. We use Table 5 to compare their average earnings when either x or y is provided. Whenever the bidders are given a choice of projects, the difference between $\pi_1(\boldsymbol{b})$ and $\pi_2(\boldsymbol{b})$ depends on the order in which the treatments are played: if M is played at the beginning of the sequence, high-value bidders earn, on average, substantially

[27] For convenience, $b_1^*(x) = -75$, $b_2^*(x) = 105$, $b_1^*(y) = 15$, and $b_2^*(y) = 55$ for treatments X and Y, as well as for treatment M in equilibria of type (b). The corresponding values for treatment M in equilibria of type (a) are $b_1^*(x) = -50$, $b_2^*(x) = 130$ (see page 12).

Table 5: Average earnings (in ECUs) per bidder under successful provision of either x or y.

Bidder	M^F sequences				M^L sequences			
	M		X	Y	M		X	Y
	x	y			x	y		
1	17.1	-13.5	24.1	22.0	10.7	26.2	18.8	21.2
2	52.9	63.5	45.9	28.0	59.3	23.8	51.2	28.8

Note: The negative entry is the average of five values: 20, 7.5, -65, -55, and 25.

more than low-value bidders (regardless of the provided project); if, on the other hand, M is played at the end of the sequence and y is provided, the average earnings of low-value and high-value bidders do not differ much. With only one project at stake, the average earnings of low-value and high-value bidders differ less in treatment Y than in treatment X (where the high-value bidders earn noticeably more).

5.2 Frequencies of success and equilibrium play

We examine the provision rates of the two projects in order to assess whether people provide x because of its (relative) efficiency, mixed feelings notwithstanding. Table 6 displays the data observations that are needed for our analysis (the maximum frequency for each of the table's entries is 32).

Project x is provided rather frequently in treatment X (65.6% and 87.5% of the cases in the M^F and M^L sequences, respectively). According to tests of equal proportions, we can not reject the null hypothesis that the probabilities of provision of x in X and y in Y are the same (the p-values equal 1.00 and 0.73 for the M^F and the M^L sequences, respectively). These findings make it clear that the presence of mixed feelings does not undermine the provision of the most efficient project. Further evidence of the participants'

Table 6: Provision frequencies of projects x and y.

	M		X	Y
	x	y		
M^F sequences	14	5	21	22
M^L sequences	16	14	28	26

preoccupation with efficiency is given by the fact that in M they provide x more often than y.

Competition from a public good project affects the provision of the project that raises mixed feelings: x is provided less often in M than in X. We tested the null hypothesis that the provision rates of x in M and X are the same, against the alternative that the provision rate of x is less in M than in X: the resulting p-value is close to the conventional 5% level for the M^F sequences (0.066), and well below it for the M^L sequences (0.002).

The provision of a public project does not necessarily imply equilibrium play.[28] With the aim of investigating how often the latter occurs, we constructed another (larger) dataset by successively pairing each type 1 bidder with all type 2 bidders. Using the 1024 bid vectors that resulted from this process (there are 32 bidders of each type in each pooled series), we computed for each vector the projects' surpluses according to bids, and used our provision rule to determine which one of them, if any, should be provided. The relative frequencies of equilibrium play that we arrived at, shown in Table 7, imply that equilibrium play is a rather rare phenomenon: the relative frequency of type (a) equilibrium is always less than 5%, and only once does

[28] The reader is reminded that in treatments X and Y the provision equilibria require that the surplus according to bids equals zero. In treatment M, for type (b) equilibria $b_1^*(p) + b_2^*(p) - C(p) = 0$, $p = x, y$ must hold. Only project x can be implemented in type (a) equilibria; the corresponding condition is $b_1^*(x) + b_2^*(x) - C(x) = S(y) = 50$.

Table 7: Simulated data: relative frequencies of type (a) and (b) equilibria and modal values of project surpluses.

	% of type (b)-like equilibria				type (a)	modal values			
	M		X	Y	M	M		X	Y
	x	y			x	x	y		
M^F	4.10	7.81	5.37	8.69	3.12	20	0	10	10
M^L	5.96	11.04	7.81	7.23	4.10	20	10	20	20

Note: 1024 pairs of bidders were used to calculate each table entry.

the relative frequency of type (b) equilibrium exceed 10%.

The final columns of the table report the most frequently observed values in the simulated surplus series. Only one mode coincides with type (b) equilibrium (M^F sequence, treatment M, project y). The modes of the x surplus series in treatment M are closer to the type (b) than to the type (a) equilibrium. We also observe that in M, the modes of x (both in M^F and in M^L) are larger than the modes of y, and that in X and Y, the modes of the series in the two sequences are the same.

Thus, there are several modal values, not necessarily stable between sequences. In addition, these values differ from the equilibrium values, which are infrequent. It is essential to inspect the probability distribution of the surplus variable.[29] For bids on x in treatment M in particular, we need to examine the key interval between type (a) and type (b) equilibria and find out whether the mass of the surplus distribution is concentrated around the mode value. For all other bids we are interested in the shape of the distribution close to the type (b)-like equilibrium, and on the way that it changes between treatments.

[29] Reporting modes makes sense with symmetric unimodal distributions, but can be misleading when several values are about equally likely to be observed (as, for example, with a sample of values drawn from a uniform distributions).

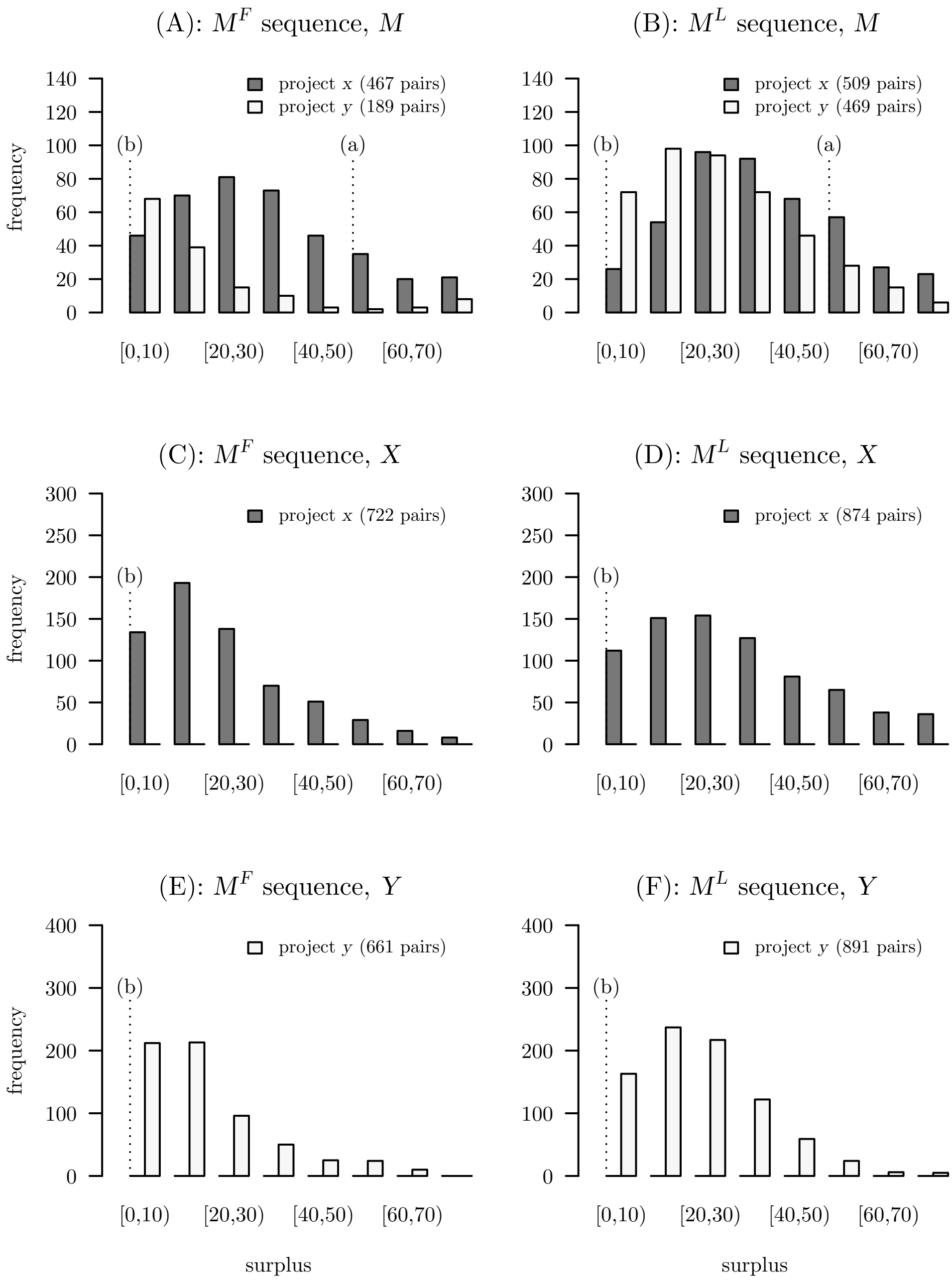

Figure 5: Simulated data: surplus histograms of provided projects.

Figure 5 draws histograms of the surpluses according to bids of the pairs of bidders that did provide a project.[30] For project x, the highest-frequency

[30]For the purposes of a clearer graphical representation of the data, we do not display

bin is either $[10, 20)$ (panel C) or $[20, 30)$ (panels A, B, and D). There is no indication of either type of equilibrium being observed more frequently than the other.[31] For project y, in the case of M in the M^F sequence (panel A), the histogram peaks at the left edge (the mode of the 189 observations is once again zero), and then it starts trailing off. In all other treatments (panels B, E, and F), we are given the impression of a positively skewed distribution that peaks *after* the first bin, a finding that does not corroborate an equilibrium-like behavior.

6 Conclusions

By imposing a few intuitive requirements we derived a procedurally fair mechanism for determining which one of several public projects should be implemented. Then, we concentrated on the simplest possible scenario, consisting of two public projects and two bidders. The main aim of our experiment was to explore whether a public project that raises mixed feelings (project x) stands a fair chance of being provided in the face of competition from a less efficient public good (project y). We wanted to study, in the context of our procedurally fair game form, the effect of mixed feelings on bid levels, provision frequencies, and equilibrium play.

Comparing the bid levels on x in the treatment where the two projects compete with each other (treatment M) with the bid levels on the same project in the treatment where it faces no competition (treatment X), we find that participants bid, on average, less in the former case than in the latter (though the difference is not significant). The provision rate of x in treatment X is considerably high (above 65%) and similar in magnitude to

their full range (0 to 370) but only the first few histogram bins.

[31] In M^F (M^L), there are more (less) observations close to 0 than close to 50.

the provision rate of y in the treatment where the standard public good constitutes the sole available option (treatment Y). Hence, it is rather the coordination problem (which is inherent in the game) than the existence of mixed feelings that should be held responsible for the provision failure of x in X. Treatment M provides further evidence that people assign little importance to mixed feelings: the public project that raises mixed feelings is implemented more often than the alternative public good.

We distinguished between two types of provision equilibria for x in M, and our analysis of equilibrium play shows that they occur rarely. Using simulated data, we found no indication of either one of them being observed more frequently than the other. Moreover, the obtained proportions of equilibrium play of x in X and y in all but one case (sequence M^F, treatment M) do not corroborate an equilibrium-like behavior.

The effect of mixed feelings on bid choices is apparently weak. Bidders (especially the low-value ones) veto the project that raises mixed feelings more often than the public good project, but the exercise of veto power is far from common practice. In comparison to bids on y, bids on x tend to deviate more from the equilibrium bids that equalize the players' monetary payoffs. Albeit the equal-payoff equilibrium is uncommon, an outcome which is hardly surprising given that ours is the worst-case scenario for observing fair outcomes.

The bidders' unwillingness to veto the project that raises mixed feelings suggests that people do not attempt to impose their will on others.[32] If the agent that attaches a negative value to project x is sufficiently compensated by the other party, then he has no reason to reject an agreement a priori. We therefore conclude that the presence of mixed feelings is not detrimental

[32] This is consistent with Buchanan's 1975 contractarian paradigm.

to cooperation, provided of course (as we assume here) that the project that raises these feelings is relatively efficient, and that the party that regards the project as "meat" is willing to compensate the party that regards it as "poison".

Finally, we detected an interesting order effect: experiencing each project separately before having to opt for either one of them induces the high-value bidders to significantly increase their bids on the public good. Playing treatment M at the end, rather than at the beginning, has further consequence. First, low-value bidders bid more truthfully on the project that raises mixed feelings, possibly because they understood more thoroughly its relative efficiency. Second, participants are able to coordinate better and provide both projects more often. More research is necessary for the generalization of our findings. But the experimental evidence garnered from the simple scenario that we considered suggests that the extent of coordination failure could be reduced, and consequently Pareto improvements could be achieved, if we were to offer one project at a time before offering them as alternatives.

References

Andreoni, J. (1995). Warm-glow versus cold-prickle: The effects of positive and negative framing on cooperation in experiments, *The Quarterly Journal of Economics* 110(1): 1–21.

Bagnoli, M. and Lipman, B. L. (1989). Provision of public goods: Fully implementing the core through private contributions, *Review of Economic Studies* 56(4): 583–601.

Bagnoli, M. and Mckee, M. (1991). Voluntary contributions games: Efficient private provision of public goods, *Economic Inquiry* 29(2): 351–366.

Buchanan, J. M. (1975). A contractarian paradigm for applying economic theory, *American Economic Review* 65(2): 225–230.

Burlando, R. and Hey, J. D. (1997). Do Anglo-Saxons free-ride more?, *Journal of Public Economics* 64(1): 41–60.

Cadsby, C. B., Croson, R., Marks, M. and Maynes, E. (2008). Step return versus net reward in the voluntary provision of a threshold public good: An adversarial collaboration, *Public Choice* 135: 277–289.

Cadsby, C. B. and Maynes, E. (1999). Voluntary provision of threshold public goods with continuous contributions: Experimental evidence, *Journal of Public Economics* 71(1): 53–73.

Fischbacher, U. (2007). Zurich toolbox for readymade economic experiments, *Experimental Economics* 10(2): 171–178.

Greiner, B. (2004). An online recruitment system for economic experiments, *in* K. Kremer and V. Macho (eds), *Forschung und wissenschaftliches Rech-*

nen 2003. GWDG Bericht 63, Gesellschaft für Wissenschaftliche Datenverarbeitung, Göttingen, pp. 79–93.

Güth, W. and Kliemt, H. (2011). Procedurally fair provision of public projects - An axiomatic characterization, Jena Economic Research Papers 2011/016.

Marks, M. and Croson, R. (1998). Alternative rebate rules in the provision of a threshold public good: An experimental investigation, *Journal of Public Economics* 67: 195–220.

Moxnes, E. and van der Heijden, E. (2003). The effect of leadership in a public bad experiment, *Journal of Conflict Resolution* 47(6): 773–795.

Ostrom, E., Gardner, R. and Walker, J. (1994). *Rules, Games, and Common-Pool Resources*, The University of Michigan Press, Ann Arbor.

Rondeau, D., Schulze, W. D. and Poe, G. L. (1999). Voluntary revelation of the demand for public goods using a provision point mechanism, *Journal of Public Economics* 72(3): 455–470.

Sonnemans, J., Schram, A. and Offerman, T. (1998). Public good provision and public bad prevention: The effect of framing, *Journal of Economic Behavior & Organization* 34: 143–161.

Spencer, M. A., Swallow, S. K., Shogren, J. F. and List, J. A. (2009). Rebate rules in threshold public good provision, *Journal of Public Economics* 93(5-6): 798–806.

A1 Experimental instructions (Not for Publication)

This appendix reports the instructions (originally in German) that we used for the sequence MXY. The instructions for the other sequences were adapted accordingly and are available upon request.

INSTRUCTIONS

Welcome! You are about to participate in an experiment funded by the Max Planck Institute of Economics. Please switch off your mobile(s) and remain silent. It is strictly forbidden to talk to other participants. Please raise your hand whenever you have a question; one of the experimenters will come to your aid.

You will receive €5.00 for showing up on time. Besides this, you can earn more. But there is also a small possibility of ending up with a loss. The show-up fee and any additional amounts of money you may earn will be paid to you in cash at the end of the experiment. Payments are carried out privately, i.e., the others will not see your earnings.

In the course of the experiment, we shall speak of ECUs (Experimental Currency Unit) rather than euros. The conversion rate is 5 ECUs per euro.

The experiment consists of three parts. The instructions for the first part follow below. The instructions for the second part will be distributed after all participants have completed the first part, and the instructions for the third part will be distributed after all participants have completed the second part.

Detailed information on the first part

You will be placed in a group of two persons (a pair). We will refer to the other person in your pair as the *other*. You and the *other* will face a one-shot situation involving two public projects, namely projects X and Y. Both of you will decide if one or none of the two projects will be realized. (The rules determining which project, if any, will be realized are described below.)

Cost of and gain from each project

Each project has a provision cost; providing X costs 30 ECUs and providing Y costs 70 ECUs. In addition, each pair member gets a certain personal gain from each project. From project X, one member of the pair loses 40 ECUs (i.e., his/her "gain" is -40 ECUs) and the other gains 140 ECUs. From project Y, the two members of the pair gain either 40 or 80 ECUs. Just for convenience, the characteristics of each individual project are summarized in the following table.

Project	Provision cost	Possible personal gain
X	30	either -40 or 140
Y	70	either 40 or 80

The gains that you and the *other* get from the projects are predetermined (you learn them at the beginning of the experiment):

- With 50% probability you will be the pair member gaining less from both projects (i.e., you will gain -40 from X and 40 from Y) and the *other* will be the pair member gaining more from both projects (i.e., 140 from X and 80 from Y).
- With 50% probability you will be the pair member gaining more from both projects (i.e., 140 from X and 80 from Y) and the *other* the one gaining less (i.e., -40 from X and 40 from Y).

It follows that one pair member (that is either you or the *other*) gains less than the other from both projects and has even a negative gain from X.

Your decision

Having learned what you and the *other* gain from the projects, you will need to determine your bids on X and Y. Regardless of your gains from the projects, your bids can be any integer number between -200 and 200 ECUs (i.e., $-200, -199, -198, \ldots, 198, 199, 200$).

Rules for the provision of a project

Given the costs of the projects, whether and which project will be realized depends on the total number of ECUs that you and the *other* bid on each project. We will refer to the difference between the sum of bids made by you and the *other* on a certain project and the provision cost of that project as the "surplus from the project". Thus:

Surplus from X = (Your bid on X + The other's bid on X) − 30.

Surplus from Y = (Your bid on Y + The other's bid on Y) − 70.

A project can be realized only if the surplus that it generates is either positive or zero (in other words if the sum of bids made by you and the *other* either exceeds or equals the project's cost). A project can not be realized if the surplus that it generates is negative (that is if the sum of bids made by you and the *other* is less than the project's cost). If both projects generate a non-negative surplus, then the one generating the higher surplus is realized (a random draw determines which project will be realized if the two projects generate the same non-negative surplus).

To sum up, the following outcomes are possible:

Outcome	Surplus from X	Surplus from Y	Realized project
1	negative	negative	none
2	negative	zero or positive	project Y
3	zero or positive	negative	project X
4	zero or positive	zero or positive	higher surplus-generating project

Your experimental earnings

Your earnings depend on whether and which project is realized.

- If no project is realized, you and the *other* get nothing.
- If one of the two projects is realized,
  - you are paid your gain from the project,
  - you pay your bid on the project if your bid is positive or collect a compensation equal to your bid if your bid is negative,
  - you receive half the *surplus from the project* (the other half goes to the *other*).

  Thus, in case that X is realized, your earnings are calculated as follows:

your gain from X	$-$	your bid on X	$+$	half of the surplus from X
(-40 or 140)	$-$	(integer within -200 to 200)	$+$	$1/2 \times$ (sum of bids on $X - 30$)

  Similarly, in case that Y is realized, your earnings are calculated as follows:

your gain from Y	$-$	your bid on Y	$+$	half of the surplus from Y
(40 or 80)	$-$	(integer within -200 to 200)	$+$	$1/2 \times$ (sum of bids on $Y - 70$)

  Note that if your bid on the realized project exceeds the gain you get from that project, then your earnings could be negative, i.e., you may suffer a loss.

The following examples should help you better understand the calculation of your earnings.

Example 1
Suppose that your gains from projects X and Y are -40 and 40, respectively. If you bid

-50 on X and 10 on Y, and the *other* bids 120 on X and 40 on Y, then the "surplus from project X" equals $(-50 + 120) - 30 = 40$ and the "surplus from project Y" equals $(10 + 40) - 70 = -20$. Consequently, project X is realized and your earnings amount to $-40 - (-50) + 1/2 \times 40 = -40 + 50 + 20 = 30$ ECUs.

Example 2
Suppose once again that your gains from projects X and Y are -40 and 40, respectively. If you bid 0 on X and 50 on Y, and the *other* bids 90 on X and 40 on Y, then the "surplus from project X" equals $(0+90)-30 = 60$ and the "surplus from project Y" equals $(50+40)-70 = 20$. Consequently, project X is realized and your earnings amount to $-40-0+1/2\times 60 = -10$ ECUs. You suffered this loss because your bid on X (i.e., 0) is more than your gain from X (i.e., -40).

Example 3
Suppose once again that your gains from projects X and Y are -40 and 40, respectively. If you bid -80 on X and 20 on Y, and the *other* bids 120 on X and 70 on Y, then the "surplus from project X" equals $(-80 + 120) - 30 = 10$ and the "surplus from project Y" equals $(20 + 70) - 70 = 20$. Consequently, project Y is realized and your earnings amount to $40 - 20 + 1/2 \times 20 = 30$ ECUs.

Timing of provided information

You will be informed about the *other*'s choices in this part only after the end of the session. Thus, you will learn

1. the *other*'s bids in the first part,
2. which project, if any, is realized in the first part, and
3. your experimental earnings in the first part

on completion of the third part of the experiment.

Your final payoff

At the end of the experiment, one experimenter will randomly select one participant by drawing a ball from an urn that contains as many balls as the number of participants. This participant will in his turn randomly select one of the three parts of the experiment by drawing a ball from an urn containing three balls numbered 1 to 3. The experimental earnings that correspond to this part will be converted to euros and paid out in cash.

In case of a negative payoff, losses up to €5.00 (= 25 ECUs) will be covered by your show-up fee. There are two alternatives concerning losses in excess of €5.00. The first is to pay the difference from your own money. The second is to pay the difference by performing (before leaving the lab) a task which consists of counting the occurrences of a specific letter in a lengthy text. You will be compensated with €1.00 for each correctly counted sentence. The drill is introduced to allow you to repay your losses; there is no way of earning extra money from it.

Summary

- You will be paired with the *other*.
- You will face projects X and Y, with costs 30 and 70 ECUs, respectively.
- The computer will determine whether you gain -40 ECUs from X and 40 ECUs from Y, or you gain 140 ECUs from X and 80 ECUs from Y.
- You will have to decide how much to bid on each project. Your bids must be integers between -200 and $+200$ ECUs.
- If we define the surplus from a project as the difference between your pair's sum of bids on the project and the provision cost of that project, then
  - If "surplus from X" and "surplus from Y" are both negative:
    * no project will be realized, and
    * your experimental earnings will be zero.
  - If "surplus from X" is negative and "surplus from Y" is zero or positive:
    * project Y will be realized, and
    * your experimental earnings will be:
      your gain from Y $-$ your bid on Y + one-half of the surplus from Y.
  - If "surplus from X" is zero or positive and "surplus from Y" is negative:
    * project X will be realized, and
    * your experimental earnings will be
      your gain from X $-$ your bid on X + one-half of the surplus from X.
  - If "surplus from X" and "surplus from Y" are both zero or positive:
    * the project generating the higher surplus will be realized (a random draw will determine the project to be realized if the surpluses are equal), and
    * your experimental earnings will be:
      your gain from the realized project $-$ your bid on the realized project
      + one-half of the surplus from the realized project.

Before starting you will have to answer some control questions which will ensure your understanding of these rules. Once everybody has answered all questions correctly, three practice rounds will help you familiarize yourself with the dynamics of the experiment. In these rounds the computer will choose the other's decisions from a set of randomly generated values. The result of these rounds will not be relevant to your final payoff.

Please remain quietly seated during the whole experiment. If you have any questions, please raise your hand now. Please click "ok" on your computer screen when you have finished reading the instructions of this part of the experiment.

Detailed information on the second part

You will face a situation similar to that encountered in the first part. But now

▷ only project X can be realized, and

▷ the participant you are matched with (i.e., the *other*) is a different one.

As before:

- the overall cost of X is 30 ECUs;
- the gain that you and the *other* get from X is either −40 or 140 ECUs. Be aware that your gain from X in this part will be identical to your gain from X in the first part (i.e., −40 if you previously gained −40, and 140 if you previously gained 140);
- you (as well as the *other*) have to place a bid on X (the bid can be any integer between −200 and +200 ECUs);
- project X will be realized only if "surplus from X" is either zero or positive (i.e., if the bids made by you and the *other* suffice to cover the project's cost).

The following outcomes are possible:

- If "surplus from X" is negative, then
  - X will not be realized, and
  - your experimental earnings will be zero.
- If "surplus from X" is zero or positive, then
  - X will be realized, and
  - your experimental earnings will be:

your gain from X	−	your bid on X	+	half of the surplus from X
(−40 or 140)	−	(integer within −200 to 200)	+	$1/2 \times$ (sum of bids on $X - 30$)

  Please note that you may once again suffer a loss if your bid on X exceeds your predetermined gain from X.

As with the previous part,

- feedback on 1) the *other*'s bid, 2) whether of not X has been realized, and 3) your experimental earnings will be provided after the end of the session;
- control questions and practice rounds will help you familiarize yourself with the rules and dynamics of this part of the experiment (the structure of the practice rounds remains the same: the computer determines randomly the other's decisions and the result are not relevant to your final payoff).

Please click "ok" if you have finished reading the instructions for the present part and have no further questions.

Detailed information on the third part

The third part of the experiment resembles the previous two. But now

▷ only project Y can be realized, and

▷ the participant you are matched with (i.e., the *other*) is someone you have never before interacted with.

As before:

- the overall cost of Y is 70 ECUs;
- the gain that you and the *other* get from Y is either 40 or 80 ECUs. Be aware that your gain from Y in this part will be identical to your gain from Y in the first part (i.e., 40 if you previously gained 40, and 80 if you previously gained 80);
- you (as well as the *other*) have to place a bid on Y (the bid can be any integer between −200 and +200 ECUs);
- project Y will be realized only if "surplus from Y" is either zero or positive (i.e., if the bids made by you and the *other* suffice to cover the project's cost).

The following outcomes are possible:

- If "surplus from Y" is negative, then
  - Y will not be realized, and
  - your experimental earnings will be zero.
- If "surplus from Y" is zero or positive, then
  - Y will be realized, and
  - your experimental earnings will be:

your gain from Y	–	your bid on Y	+	half of the surplus from Y
(40 or 80)	–	(integer within −200 to 200)	+	$1/2 \times$ (sum of bids on $Y - 70$)

Be aware that you may once again suffer a loss if your bid on Y exceeds your predetermined gain from Y.

Control questions and practice rounds will help you familiarize yourself with the rules and dynamics of this part of the experiment (the structure of the practice rounds remains the same: the computer determines randomly the other's decisions and the result are not relevant to your final payoff).

Please click "ok" if you have finished reading the instructions for the present part and have no further questions.

A2 Raw data (Not for Publication)

The following tables document our raw data (arranged by session). In all tables, S_p^b denotes the surplus according to bids of project p.

For the interested reader, we identify here the individual bidders that we referred to in the main text:

- Participants 21 of session 3 and 11 of session 4 bid in treatment M -100 and -99 ECUs, respectively (footnote 23).
- The participant whose bid of 180 in treatment X is an outlier too (same footnote) is participant 16 of session 3.
- The participant whose four bids equal 200 ECUs (page 21, discussion on overbidding and outlier observations) is the 25th participant of the second session.
- The four cases where the project is provided with the bids of one pair member satisfying condition (1) and the payoff of the other pair member being negative (Table 2, footnotes) are:
  - M^F, Session 2, participant 18 (group 2): $b_2^M(x) = 50$ but x is provided,
  - M^F, Session 2, participant 23 (group 12): $b_2^M(y) = -20$ but y is provided,
  - M^L, Session 1, participant 24 (group 11): $b_1^Y(y) = -20$ but y is provided, and
  - M^F, Session 4, participant 21 (group 11): $b_2^X(x) = 60$ but x is provided.

Table 9: Session 1 (sequence MXY), treatment M.

group	subject	role	$b_i^M(x)$	$b_i^M(y)$	S_x^b	S_y^b	implemented	payoff
1	29	1	-200	200	-120	190	y	-65.00
	21	2	110	60				115.00
2	26	1	-60	-100	10	-125	x	25.00
	6	2	100	45				45.00
3	13	1	-70	20	-50	0	y	20.00
	2	2	50	50				30.00
4	25	1	-200	35	-130	5	y	7.50
	18	2	100	40				42.50
5	1	1	-200	10	-160	-20	-	0.00
	22	2	70	40				0.00
6	14	1	-40	30	15	5	x	7.50
	31	2	85	45				62.50
7	11	1	0	35	-5	-5	-	0.00
	27	2	25	30				0.00
8	28	1	-50	50	-75	-15	-	0.00
	4	2	5	5				0.00
9	24	1	-40	-10	-10	-180	-	0.00
	8	2	60	-100				0.00
10	16	1	0	5	50	-15	x	-15.00
	5	2	80	50				85.00
11	7	1	-80	20	-10	-20	-	0.00
	9	2	100	30				0.00
12	20	1	-70	15	-40	-75	-	0.00
	23	2	60	-20				0.00
13	3	1	-60	10	10	-10	x	25.00
	19	2	100	50				45.00
14	10	1	-80	-20	-10	-50	-	0.00
	17	2	100	40				0.00
15	30	1	-60	20	10	-10	x	25.00
	32	2	100	40				45.00
16	15	1	-50	10	-30	-10	-	0.00
	12	2	50	50				0.00

S_p^b, $p = x, y$, denotes in this and the following tables the surplus according to bids of project p.

Table 10: Session 1 (sequence MXY), treatment X.

group	subject	role	$b_i^M(x)$	S_x^b	implemented	payoff
1	15	1	-60	10	x	25.00
	21	2	100			45.00
2	29	1	-60	10	x	25.00
	6	2	100			45.00
3	26	1	-60	-40	-	0.00
	2	2	50			0.00
4	13	1	-60	10	x	25.00
	18	2	100			45.00
5	25	1	-45	125	x	67.50
	22	2	200			2.50
6	1	1	-100	-25	-	0.00
	31	2	105			0.00
7	14	1	-50	-38	-	0.00
	27	2	42			0.00
8	11	1	-50	20	x	20.00
	4	2	100			50.00
9	28	1	-60	20	x	30.00
	8	2	110			40.00
10	24	1	-60	10	x	25.00
	5	2	100			45.00
11	16	1	-40	30	x	15.00
	9	2	100			55.00
12	7	1	-80	-16	-	0.00
	23	2	94			0.00
13	20	1	-65	25	x	37.50
	19	2	120			32.50
14	3	1	-60	20	x	30.00
	17	2	110			40.00
15	10	1	-65	5	x	27.50
	32	2	100			42.50
16	30	1	-45	15	x	12.50
	12	2	90			57.50

Table 11: Session 1 (sequence MXY), treatment Y.

group	subject	role	$b_i^M(y)$	S_y^b	implemented	payoff
1	30	1	25	15	y	22.50
	21	2	60			27.50
2	15	1	10	-5	-	0.00
	6	2	55			0.00
3	29	1	0	-20	-	0.00
	2	2	50			0.00
4	26	1	30	10	y	15.00
	18	2	50			35.00
5	13	1	10	20	y	40.00
	22	2	80			10.00
6	25	1	25	15	y	22.50
	31	2	60			27.50
7	1	1	-70	-115	-	0.00
	27	2	25			0.00
8	14	1	25	15	y	22.50
	4	2	60			27.50
9	11	1	35	25	y	17.50
	8	2	60			32.50
10	28	1	30	20	y	20.00
	5	2	60			30.00
11	24	1	-20	10	y	65.00
	9	2	100			-15.00
12	16	1	5	-3	-	0.00
	23	2	62			0.00
13	7	1	15	5	y	27.50
	19	2	60			22.50
14	20	1	20	5	y	22.50
	17	2	55			27.50
15	3	1	15	-15	-	0.00
	32	2	40			0.00
16	10	1	20	5	y	22.50
	12	2	55			27.50

Table 12: Session 2 (sequence MYX), treatment M.

group	subject	role	$b_i^M(x)$	$b_i^M(y)$	S_x^b	S_y^b	implemented	payoff
1	32	1	-60	20	110	-250	x	75.00
	14	2	200	-200				-5.00
2	25	1	200	200	220	180	x	-130.00
	18	2	50	50				200.00
3	13	1	-50	30	40	-90	x	30.00
	5	2	120	-50				40.00
4	30	1	-200	10	-90	-20	-	0.00
	6	2	140	40				0.00
5	20	1	-50	30	-20	-70	-	0.00
	19	2	60	-30				0.00
6	9	1	-75	-35	15	-40	x	42.50
	11	2	120	65				27.50
7	8	1	-40	40	60	40	x	30.00
	27	2	130	70				40.00
8	22	1	-65	15	-20	-85	-	0.00
	4	2	75	-30				0.00
9	1	1	-60	20	40	-80	x	40.00
	10	2	130	-30				30.00
10	24	1	-59	25	1	-15	x	19.50
	21	2	90	30				50.50
11	28	1	-50	25	-20	-25	-	0.00
	17	2	60	20				0.00
12	7	1	-100	100	-80	10	y	-55.00
	23	2	50	-20				105.00
13	26	1	-50	30	20	0	x	20.00
	29	2	100	40				50.00
14	3	1	-140	-20	-59	-39	-	0.00
	2	2	111	51				0.00
15	15	1	-60	25	50	15	x	45.00
	31	2	140	60				25.00
16	12	1	-70	20	10	10	y	25.00
	16	2	110	60				25.00

Table 13: Session 2 (sequence MYX), treatment Y.

group	subject	role	$b_i^M(y)$	S_y^b	implemented	payoff
1	12	1	20	30	y	35.00
	14	2	80			15.00
2	32	1	11	-209	-	0.00
	18	2	-150			0.00
3	25	1	200	230	y	-45.00
	5	2	100			95.00
4	13	1	30	10	y	15.00
	6	2	50			35.00
5	30	1	10	-15	-	0.00
	19	2	45			0.00
6	20	1	30	30	y	25.00
	11	2	70			25.00
7	9	1	-35	-26	-	0.00
	27	2	79			0.00
8	8	1	20	5	y	22.50
	4	2	55			27.50
9	22	1	20	20	y	30.00
	10	2	70			20.00
10	1	1	20	5	y	22.50
	21	2	55			27.50
11	24	1	25	15	y	22.50
	17	2	60			27.50
12	28	1	25	5	y	17.50
	23	2	50			32.50
13	7	1	0	-20	-	0.00
	29	2	50			0.00
14	26	1	25	5	y	17.50
	2	2	50			32.50
15	3	1	-10	-40	-	0.00
	31	2	40			0.00
16	15	1	16	1	y	24.50
	16	2	55			25.50

Table 14: Session 2 (sequence MYX), treatment X.

group	subject	role	$b_i^M(x)$	S_x^b	implemented	payoff
1	15	1	-45	65	x	37.50
	14	2	140			32.50
2	12	1	-70	0	x	30.00
	18	2	100			40.00
3	32	1	-65	75	x	62.50
	5	2	170			7.50
4	25	1	200	250	x	-115.00
	6	2	80			185.00
5	13	1	-50	20	x	20.00
	19	2	100			50.00
6	30	1	-55	35	x	32.50
	11	2	120			37.50
7	20	1	-50	59	x	39.50
	27	2	139			30.50
8	9	1	-75	-30	-	0.00
	4	2	75			0.00
9	8	1	-70	-19	-	0.00
	10	2	81			0.00
10	22	1	-65	-5	-	0.00
	21	2	90			0.00
11	1	1	-60	40	x	40.00
	17	2	130			30.00
12	24	1	-60	-30	-	0.00
	23	2	60			0.00
13	28	1	-60	-13	-	0.00
	29	2	77			0.00
14	7	1	-50	20	x	20.00
	2	2	100			50.00
15	26	1	-55	-35	-	0.00
	31	2	50			0.00
16	3	1	-80	-5	-	0.00
	16	2	105			0.00

Table 15: Session 3 (sequence XYM), treatment X.

group	subject	role	$b_i^M(x)$	S_x^b	implemented	payoff
1	32	1	-50	30	x	25.00
	28	2	110			45.00
2	18	1	-60	15	x	27.50
	14	2	105			42.50
3	3	1	-40	110	x	55.00
	16	2	180			15.00
4	29	1	0	90	x	5.00
	24	2	120			65.00
5	2	1	40	115	x	-22.50
	26	2	105			92.50
6	20	1	-30	20	x	0.00
	7	2	80			70.00
7	31	1	-50	60	x	40.00
	10	2	140			30.00
8	13	1	-50	10	x	15.00
	9	2	90			55.00
9	8	1	-80	-10	-	0.00
	11	2	100			0.00
10	6	1	100	180	x	-50.00
	4	2	110			120.00
11	5	1	-40	50	x	25.00
	22	2	120			45.00
12	23	1	-40	0	x	0.00
	1	2	70			70.00
13	15	1	-60	10	x	25.00
	17	2	100			45.00
14	27	1	-60	10	x	25.00
	30	2	100			45.00
15	12	1	-60	10	x	25.00
	25	2	100			45.00
16	19	1	-47	33	x	23.50
	21	2	110			46.50

Table 16: Session 3 (sequence XYM), treatment Y.

group	subject	role	$b_i^M(y)$	S_y^b	implemented	payoff
1	19	1	0	-10	-	0.00
	28	2	60			0.00
2	32	1	30	15	y	17.50
	14	2	55			32.50
3	18	1	40	110	y	55.00
	16	2	140			-5.00
4	3	1	40	50	y	25.00
	24	2	80			25.00
5	29	1	50	35	y	7.50
	26	2	55			42.50
6	2	1	20	1	y	20.50
	7	2	51			29.50
7	20	1	30	10	y	15.00
	10	2	50			35.00
8	31	1	50	50	y	15.00
	9	2	70			35.00
9	13	1	20	5	y	22.50
	11	2	55			27.50
10	8	1	15	10	y	30.00
	4	2	65			20.00
11	6	1	100	90	y	-15.00
	22	2	60			65.00
12	5	1	30	20	y	20.00
	1	2	60			30.00
13	23	1	10	-10	-	0.00
	17	2	50			0.00
14	15	1	20	0	y	20.00
	30	2	50			30.00
15	27	1	-150	-145	-	0.00
	25	2	75			0.00
16	12	1	30	33	y	26.50
	21	2	73			23.50

Table 17: Session 3 (sequence XYM), treatment M.

group	subject	role	$b_i^M(x)$	$b_i^M(y)$	S_x^b	S_y^b	implemented	payoff
1	12	1	-50	30	20	10	x	20.00
	28	2	100	50				50.00
2	19	1	-40	0	35	-25	x	17.50
	14	2	105	45				52.50
3	32	1	-50	30	-10	100	y	60.00
	16	2	70	140				-10.00
4	18	1	-65	30	35	35	y	27.50
	24	2	130	75				22.50
5	3	1	-40	40	36	25	x	18.00
	26	2	106	55				52.00
6	29	1	200	200	260	180	x	-110.00
	7	2	90	50				180.00
7	2	1	0	20	80	0	x	0.00
	10	2	110	50				70.00
8	20	1	-30	20	40	20	x	10.00
	9	2	100	70				60.00
9	31	1	-50	40	20	20	x	20.00
	11	2	100	50				50.00
10	13	1	-50	20	40	15	x	30.00
	4	2	120	65				40.00
11	8	1	-75	15	15	5	x	42.50
	22	2	120	60				27.50
12	6	1	50	60	125	50	x	-27.50
	1	2	105	60				97.50
13	5	1	-40	40	10	20	y	10.00
	17	2	80	50				40.00
14	23	1	-20	10	30	-20	x	-5.00
	30	2	80	40				75.00
15	15	1	-50	20	20	25	y	32.50
	25	2	100	75				17.50
16	27	1	-200	50	-330	53	y	16.50
	21	2	-100	73				33.50

Table 18: Session 4 (sequence YXM), treatment Y.

group	subject	role	$b_i^M(y)$	S_y^b	implemented	payoff
1	8	1	25	10	y	20.00
	18	2	55			30.00
2	12	1	25	-5	-	0.00
	10	2	40			0.00
3	29	1	20	0	y	20.00
	1	2	50			30.00
4	7	1	20	20	y	30.00
	13	2	70			20.00
5	5	1	40	30	y	15.00
	6	2	60			35.00
6	17	1	30	15	y	17.50
	15	2	55			32.50
7	24	1	35	55	y	32.50
	11	2	90			17.50
8	19	1	35	25	y	17.50
	4	2	60			32.50
9	23	1	35	25	y	17.50
	31	2	60			32.50
10	22	1	20	20	y	30.00
	30	2	70			20.00
11	14	1	21	-9	-	0.00
	21	2	40			0.00
12	3	1	30	-10	-	0.00
	9	2	30			0.00
13	26	1	10	0	y	30.00
	20	2	60			20.00
14	28	1	30	20	y	20.00
	16	2	60			30.00
15	27	1	30	20	y	20.00
	2	2	60			30.00
16	25	1	20	5	y	22.50
	32	2	55			27.50

Table 19: Session 4 (sequence YXM), treatment X.

group	subject	role	$b_i^M(x)$	S_x^b	implemented	payoff
1	25	1	-60	10	x	25.00
	18	2	100			45.00
2	8	1	-40	-10	-	0.00
	10	2	60			0.00
3	12	1	-40	30	x	15.00
	1	2	100			55.00
4	29	1	-70	40	x	50.00
	13	2	140			20.00
5	7	1	-60	30	x	35.00
	6	2	120			35.00
6	5	1	-50	25	x	22.50
	15	2	105			47.50
7	17	1	-70	-15	-	0.00
	11	2	85			0.00
8	24	1	-70	40	x	50.00
	4	2	140			20.00
9	19	1	-20	50	x	5.00
	31	2	100			65.00
10	23	1	-50	10	x	15.00
	30	2	90			55.00
11	22	1	-20	10	x	-15.00
	21	2	60			85.00
12	14	1	-65	5	x	27.50
	9	2	100			42.50
13	3	1	-80	-20	-	0.00
	20	2	90			0.00
14	26	1	-50	10	x	15.00
	16	2	90			55.00
15	28	1	-70	10	x	35.00
	2	2	110			35.00
16	27	1	-55	25	x	27.50
	32	2	110			42.50

Table 20: Session 4 (sequence YXM), treatment M.

group	subject	role	$b_i^M(x)$	$b_i^M(y)$	S_x^b	S_y^b	implemented	payoff
1	27	1	-65	35	5	20	y	15.00
	18	2	100	55				35.00
2	25	1	-60	20	-30	-10	-	0.00
	10	2	60	40				0.00
3	8	1	-40	30	30	10	x	15.00
	1	2	100	50				55.00
4	12	1	-35	35	5	65	y	37.50
	13	2	70	100				12.50
5	29	1	-70	20	0	10	y	25.00
	6	2	100	60				25.00
6	7	1	-65	25	10	-5	x	30.00
	15	2	105	40				40.00
7	5	1	-50	30	-179	20	y	20.00
	11	2	-99	60				30.00
8	17	1	-70	30	40	20	x	50.00
	4	2	140	60				20.00
9	24	1	-60	25	10	15	y	22.50
	31	2	100	60				27.50
10	19	1	-25	25	-20	45	y	37.50
	30	2	35	90				12.50
11	23	1	-50	35	-20	5	y	7.50
	21	2	60	40				42.50
12	22	1	-20	20	-20	30	y	35.00
	9	2	30	80				15.00
13	14	1	-75	10	-25	-10	-	0.00
	20	2	80	50				0.00
14	3	1	-80	30	-15	20	y	20.00
	16	2	95	60				30.00
15	26	1	-45	10	41	-22	x	25.50
	2	2	116	38				44.50
16	28	1	-65	15	20	-5	x	35.00
	32	2	115	50				35.00